11. GEOCHEMISTRY OF HYDROTHERMALLY ALTERED SEDIMENT, MIDDLE VALLEY, NORTHERN JUAN DE FUCA RIDGE^{1,2}

Wayne D. Goodfellow³ and Jan M. Peter³

ABSTRACT

Two distinct hydrothermal fluid upflow zones were penetrated during Ocean Drilling Program Leg 139 drilling in Middle Valley: Site 856, Bent Hill (BH), and Site 858, the Area of Active Venting (AAV). The BH upflow zone is a fossil hydrothermal fluid discharge conduit adjacent to a major sulfide deposit near the southern flank of a sediment mound. Hydrothermal minerals in this discharge conduit are zoned about a high-temperature, silicified core outward to weakly altered sediment as follows: (1) quartz + Fe-chlorite + muscovite + rutile; (2) albite + Mg-chlorite + muscovite + pyrite; (3) anhydrite + illite + barite + pyrite; and (4) calcite + illite + pyrite. The inner core has gained Si, Fe, Al, Mg, S, K, Mn, Cu, Ba, Zn, Se, Co, and Cr, and lost Ca, Na, CO₂, TOC (total organic C), As, and Sc. In the surrounding alteration zones, Mg and Fe have been added at the expense of alkali elements bound in detrital feldspar and micas.

The AAV upflow zone is associated with anhydrite-sulfide chimneys that are actively discharging 184°–276°C fluids. Hydrothermal minerals are zoned from a fractured, veined, and brecciated core outward to weakly altered sediment as follows: (1) quartz + wairakite + epidote + pyrite; (2) quartz + epidote + chlorite; (3) albite + chlorite + illite + pyrite; (4) anhydrite + illite + pyrite; and (5) carbonate + illite + pyrite. The major elements added to the core of the conduit include Ca, Si, Al, and H; elements removed include Fe, Na, K, CO₂, TOC, Ba, Sr, Rb, Zn, As, Cu, Ni, and V. ⁸⁷Sr/⁸⁶Sr ratios for wairakite-quartz from Zone 1b (0.704853) are similar to average values for AAV vent fluids (0.70424).

The textural, mineralogical, and chemical zonation about the AAV and BH upflow zones is consistent with precipitation from upflowing and outflowing hydrothermal fluid that mixed with heated down-drawn seawater at the margins of the discharge conduit. The inner core assemblages precipitated in response to reaction between sediments and end-member hydrothermal fluid, whereas the surrounding alteration zones formed by the reaction of sediments with chemically evolved hydrothermal fluids and heated entrained seawater. Although the BH and AAV upflow zones are similar in size and morphology, they are mineralogically and geochemically distinct and reflect contrasting fluid compositions, temperatures, fluid-sediment reaction conditions, and probably fluid sources.

At Site 857, hydrothermal minerals in sediments are zoned upward from fractured, brecciated, and veined sediments containing quartz ± wairakite + epidote + chlorite (Zones 1c and Zone 1d) between 450 and 936 mbsf, to albite + chlorite + pyrite (300–450 mbsf) and carbonate-illite-pyrite (70–300 mbsf). Elements that have been markedly depleted from Zone 1c include K, Ba, Na, CO₂, Rb, TOC, Cu, Zn, As, Sb, Se, Be, and Co; elements added are Si, Ca, Al, and Sr. ⁸⁷Sr/⁸⁶Sr ratios for wairakite-quartz in Zone 1c (0.704094) are similar to ratios for average AAV vent fluids (0.70424). The similarities of mineralogy, bulk chemical and isotope composition, and temperature (fluid inclusion temperatures of 250° to 350°C) between hydrothermally altered sediment in the core of the AAV upflow zone and altered sediment in the sill complex at nearby Site 857 indicate a common fluid source. The sediment-sill complex at the base of the sedimentary sequence near the transition from sedimentary to predominantly mafic igneous rocks represents a hydrothermal-reaction zone where elements in AAV end-member vent fluids were leached.

The Middle Valley hydrothermal system has evolved with time and consisted initially of (1) a reaction zone, probably in basaltic crust near a high-level magma body, where high-temperature, metal-rich "black smoker"-type fluids were generated, and (2) a secondary reaction zone in the sill complex near the base of the sedimentary pile where these high-temperature fluids were modified by reaction with sediments which probably contained anhydrite. It was this modified high-temperature system that generated the large, hydrothermally inactive BH massive sulfide deposit at Site 856. The active hydrothermal system at the AAV and south of BH is lower temperature and appears to be contained within the sediment-sill complex below about 450 mbsf. Hydrothermal fluids from this active system are generally <300°C and metal-poor. Hydrothermal precipitates from these fluids consist of anhydrite-sulfide chimneys with Cu/Zn ratios significantly greater than those for massive sulfides at BH.

INTRODUCTION

Middle Valley is an oceanic rift at the northern extremity of the Juan de Fuca Ridge (Fig. 1) that has been partly filled by interbedded hemipelagic and turbiditic sediment. Seismic profiles show that the sedimentary sequence thickens from only a few meters near the margins of the rift to over 300 meters near the center and northward toward the Sovanco Transform where thicknesses exceed 1000 m (Davis and Villinger, 1992). Two major areas of hydrothermal fluid discharge and sulfide deposition have been described within Middle Valley: Site 856

(Bent Hill [BH]) and Site 858 (Area of Active Venting [AAV]) (Fig. 2; Davis et al., 1987; Goodfellow and Blaise, 1988; Goodfellow and Franklin, 1993; Davis, Mottl, Fisher, et al., 1992).

Unaltered to intensely altered hemipelagic and turbiditic sediment was sampled from Ocean Drilling Program (ODP) drill core recovered from Middle Valley. Hydrothermally altered sediment is associated with both fossil (Site 856) and active (Site 858) fluid-upflow zones, and with a hydrothermal-reaction zone within the sill-sediment complex below 450 mbsf at Site 857. The reaction zone at Site 857 is defined as a hydrothermal fluid reservoir that behaves essentially isothermally because of the high fracture-controlled permeability, and that is in equilibrium with end-member fluids that are actively venting at the AAV. This chapter describes the geochemistry of sediment cores with the objectives of characterizing both altered and unaltered hemipelagic and turbiditic sediment and quantifying chemical changes due to hydrothermal alteration. Furthermore, we relate these alteration effects to mineralogy and mineral chemistry, place constraints on

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² Geological Survey of Canada Contribution No. 22293.

³ Geological Survey of Canada, 601 Booth Street, Ottawa, Ontario, Canada K1A 0E8.

Figure 1. Map of the Juan de Fuca Ridge system showing the main tectonic elements and the location of Middle Valley at the northern extremity of the ridge. Arrows indicate the direction of subduction of the Juan de Fuca plate beneath western North America.

hydrothermal-reaction conditions as a function of distance from fluid discharge centers, and infer the sources of hydrothermal fluids.

SAMPLING AND ANALYTICAL METHODS

Unaltered hemipelagic and turbiditic sediments were collected from Holes 855A, 855B, and 855C near the eastern margin of the Middle Valley Rift, the upper portions of Hole 856A (above 20 mbsf) at Bent Hill, Hole 858A (above 10 mbsf) near the center of the rift, the Area of Active Venting, and from Hole 857A, 3 km south of AAV (Davis and Sawyer, 1987; Davis, Mottl, Fisher, et al., 1992). The locations of the four sites are shown in Figure 2. Sediment cores were collected by hydraulic piston coring, extended core barrel diamond coring, and rotary drilling using a tricone bit. Six hundred and twelve samples were collected from the cores; sampling techniques are given in Davis, Mottl, Fisher, et al. (1992). Sediment cores with greater than 90% recovery were sampled at 5- to 10-m intervals, whereas cores with poor recovery were sampled at greater intervals. Soft or friable sediment was vacuum-impregnated with epoxy prior to preparation of pol-

ished thin sections. The mineralogy of selected samples was determined using methods described by Chamley (1971) and Holtzapffel (1985). X-ray diffractograms were obtained with a General Electric XRD-3R diffractometer using $\text{Cu}_{K\alpha}$ radiation at 45 kv and 16 mA, and a scan rate of two degrees 2θ per minute from 2.5° to $25^\circ 2\theta$.

Samples were dried in an oven at 110°C and pulverized and ground to <200 mesh. A 0.5-g sample was fused with lithium metaborate and subsequently dissolved in 5% HNO_3 . Samples were weighed before and after drying to determine the nonstructurally bound water content and porosity. Sediment samples were not washed prior to drying because of the possibility of dissolving highly soluble minerals (e.g., anhydrite, iron monosulfides) and the difficulty of recovering fine (<0.1 μm) clays during the filtration of suspended sediment. Water-extractable Na was determined on most samples in order to correct for salt precipitated from pore water during drying. Analyses were performed at the Geological Survey of Canada using the following methods: induction coupled plasma-emission spectrometry: SiO_2 , TiO_2 , Al_2O_3 , K_2O , Na_2O , CaO , MgO , P_2O_5 , MnO , $\text{Fe}_2\text{O}_3\text{T}$ (total iron), Ba, Ag, Be, Co, Cr, Cu, La, Ni, Pb, Sr, V, Yb and Zn; atomic absorp-

Figure 2. Seabeam bathymetric map of Middle Valley showing the location of Leg 139 drill sites (Davis and Sawyer, 1987).

tion spectrometry: As, Sb, Se, Mo; combustion and wet chemical methods: FeO, Fe₂O₃, H₂O, CO₂, total organic carbon (TOC) and S. Major and trace element contents were determined for all collected samples and are given in Table 1 (located at the end of this chapter).

GEOLOGICAL SETTING

Unaltered Sediment

The sedimentary sequence in Middle Valley consists of Holocene and Pleistocene interbedded hemipelagic and turbiditic sediment (Goodfellow and Blaise, 1988; Davis, Mottl, Fisher, et al., 1992). The uppermost sediments, which extend up to 12 cm below the seafloor, are water-saturated, oxidized, brownish gray, and of hemipelagic origin. Below this oxidized surface layer, hemipelagic sediment is commonly parallel-laminated and ranges in color from yellow-olive gray to olive gray and dark gray. In general, there is a change from olive gray to gray with depth. A dark gray hemipelagic sediment unit with horizontal zoophycos worm burrows occurs between 2 and 6 mbsf and has been used by Goodfellow et al. (1993) as a time-stratigraphic marker in the AAV. At depths greater than one meter, hemipelagic sediment is interbedded with medium- to dark-gray turbiditic silt and sand. Individual beds vary in thickness from <1 cm to several meters, and typically fine upward into hemipelagic, silty clay. The silt-sand beds are commonly parallel-laminated and less commonly cross-laminated with sharp and scoured bases. The percentage of the sedimentary sequence represented by turbidites is highly variable (Davis, Mottl, Fisher, et al., 1992).

Microfossils are most common in the olive-gray muds and consist of foraminifers, nannofossils, diatoms, and radiolarians. Planktonic foraminifers (*Globigerina buloides*) in carbonate-rich beds from 75–77 cm depth in PAR 85-28 have a ¹⁴C age of 13,490 (±210) aBP (Goodfellow and Blaise, 1988). This same species occurs at 64–66 cm, 78–79 cm, 160–162 cm, and 847–848 cm in PAR 85-34 have been dated at 10,260 (±2,470), 12,090 (±170), 13,900 (±180) and 21,010 (±280) aBP (Goodfellow and Blaise, 1988; Goodfellow et al., 1993). Average Holocene sedimentation rates for the uppermost part of the sedimentary column calculated using these dates are 5.5–5.8 cm k.y.⁻¹ for core PAR 85-28 from BH, and 6.2–6.4 cm k.y.⁻¹ for core PAR 85-34 from AAV. The lower sedimentation rate in core PAR85-28 may indicate that BH was a positive bathymetric feature during most of the Holocene. Average sedimentation rates for Holocene and latest Pleistocene sediment in core PAR85-34 are much higher (40 cm k.y.⁻¹) due to the influx of turbidites in the late Pleistocene.

Site 856, Bent Hill

BH is one in a chain of sediment mounds that are oriented approximately north-northeast and are parallel to extensional faults bounding the Middle Valley rift (Fig. 2). BH is 60 m high by 400 m wide and is truncated to the west by a north-south fault (Goodfellow and Franklin, 1993; Davis, Mottl, Fisher, et al., 1992). Fault scarps separated by domino structures were observed by submersible along the western flanks of BH. Near the southern margin of BH is a 35 m high by 100 m wide hydrothermally inactive sulfide mound. The mound consists of brittle star-encrusted, angular blocks of sulfide rubble near the summit and interbedded hemipelagic sediment and clastic sulfides on the flanks. Most of the rubble is oxidized to a rusty brown color.

About 300 m south of BH are two smaller 25-m-high sulfide mounds with blocks of sulfides on the flanks; near the summit of the northernmost mound, an anhydrite chimney was observed to vent 265°C clear fluids (Franklin and Leg 139 Scientific Party, 1992). The surface of the mound is covered by rubble composed of pale-gray anhydrite and gray to rusty-brown sulfide, and is surrounded by depressions that are partly filled with finer-grained, pale-gray and rusty-brown hydrothermal sediment. Shallow sediment cores from these depressions consist of interbedded, resedimented anhydrite and sulfide. Fauna are more abundant on the sulfide rubble than on the

hemipelagic sediment and include spherical sponges, galatheid crabs, sea anemones, rattail fish, and rare shrimp (Goodfellow and Franklin, 1993).

Stratigraphy and Sedimentology

Locations of cores from Site 856 and the limits of BH mounds are shown in Figure 3. Cores from Holes 856A and 856B were collared on BH, whereas the remaining holes penetrated the sulfide mound near the southern margin of BH (Fig. 3) (Davis, Mottl, Fisher, et al., 1992). The western margin of BH has a step and scarp morphology that probably resulted from reverse normal faulting. This faulting may have formed tilted slump blocks and mud-clast breccias observed in shallow cores (Goodfellow and Franklin, 1993). Multiple slumped sulfide and mud-clast breccia units that occur on the flanks of the sulfide mound have resulted in a complex stratigraphy and sedimentology in the BH area.

Cores from Holes 856A and 856B consist mainly of interbedded hemipelagic and turbiditic sediments that have been intruded by mafic sills (Davis, Mottl, Fisher, et al., 1992). Slumped and tilted massive sulfide beds occur between 18 and 30 mbsf in Hole 856B, and the sediment is brecciated between 30 and 60 mbsf. Sediments in both holes have been hydrothermally altered with the intensity of alteration generally increasing with depth.

Site 858, Area of Active Venting

Site 858 encompasses an 800-m by 400-m vent field (AAV) situated 2.4 km northwest of BH (Fig. 2), immediately east and on the down-thrown side of an extensional fault parallel to the rifted margins of Middle Valley. The AAV hosts at least 11 hydrothermal vents discharging hydrothermal fluids up to 276°C from anhydrite chimneys situated near the summit of sediment mounds (Franklin et al., 1992; Lydon et al., 1992; Goodfellow and Franklin, 1993; Butterfield et al., this volume). SeaMARC 1A images show that the AAV occurs near a right-lateral offset of a rift-parallel extensional fault that penetrates the present-day seafloor. The vents and associated hydrothermal mounds are oriented northwest along what is thought to be a conjugate set of orthogonal extensional faults.

The AAV occurs in a bathymetric low and is an area of high acoustic reflectivity outlined by a SeaMARC 1A side-scan sonar survey of the area (Goodfellow and Franklin, 1993; Fig. 4). The high reflectivity results from the roughness of mound exteriors, hydrothermal sulfide, sulfate and silicate sediment near vents, and the alteration of the uppermost sediment by hydrothermal fluids (Goodfellow et al., 1993). The correspondence between these features, high heat flow (Davis and Villinger, 1992), and pore fluids enriched in Si, Ca and Ba and depleted in Mg (Lydon et al., 1991) suggests that the high acoustic reflectivity results from the advection of hydrothermal fluids through the sedimentary sequence.

Detailed observations of the AAV mound structures were made in 1990 using the submersible *Alvin* (Goodfellow and Franklin, 1993). Mounds typically range to 15 m high and 100 m in diameter and consist of a mixture of hydrothermal sediment and altered hemipelagic and turbiditic sediment. Anhydrite-sulfide chimneys venting 184° to 276°C fluids were observed near the summit of most mounds. Mound surfaces consist of anhydrite-sulfate-sulfide rubble formed from the collapse of chimneys and uplifted blocky sediment. The flanks of mounds are composed of sulfide rubble and blocky hemipelagic sediment. Vestimentiferan tube worms and clams cluster along fractures in the blocky sediment surface. Accumulations of dead clams were also observed on mound structures near extinct vent sites.

Hydrocarbon-impregnated barite-silica chimneys that formed at about 265°C occur on flat surfaces between mounds (Turner et al., 1991; Leitch, 1991). Hydrothermal bitumen which fills open spaces within barite chimneys is composed of a mixture of high- and low-temperature organic alteration products (Simoneit et al., 1992). The aliphatic fraction represents organic matter that was weakly trans-

Figure 3. Map showing Bent Hill, the sulfide mound near the southern flank, and the southern sulfide mounds with a hydrothermally active anhydrite-sulfide chimney, and drill hole positions. Line A-B shows location of cross-section in Fig. 7.

formed at low temperatures (50°–120°C). The major polynuclear aromatic hydrocarbons are estimated to have formed at >300°C. The ^{14}C age of this hydrocarbon is 29,000 aBP and indicates rapid recycling of sedimentary organic matter at shallow (<12m) depths (Simoneit et al., 1992).

Hydrothermal sediment forms the uppermost layer in all cores from mounds and ranges up to 80 cm in thickness (Goodfellow and Franklin, 1993). This sediment consists of crudely interbedded, clastic hydrothermal sediment that probably formed by the partial dissolution and collapse of inactive anhydrite-sulfide chimneys. The clastic beds are poorly sorted, show no visible grading, and are composed of anhydrite, gypsum, sulfide, and hydrothermal clay clasts in a fine-grained matrix of similar composition. The acicular gypsum crystals are morphologically similar to anhydrite in active chimneys, suggesting that gypsum formed by the hydration of anhydrite. Individual clasts range up to 4 cm in diameter and average 0.5 cm in diameter. The proportions of sulfide and hydrothermal clay relative to anhydrite increase with depth, suggesting retrograde dissolution of anhydrite (Blount and Dickson, 1969) as the sediment becomes buried. In core ALV-2255-5-1P, clastic anhydrite and sulfide beds overlie a 3-cm-thick bed of black massive sulfide containing fine-grained pyrrhotite, chalcopyrite, pyrite, sphalerite, galena, and anhydrite (Goodfellow and Franklin, 1993). This massive sulfide bed conformably overlies hemipelagic sediment that has been hydrothermally altered to talc and Mg-rich smectite.

Fauna in the AAV are limited in abundance but are remarkably specious (Juniper et al., 1992). Fifty-six vent species were documented; 15 of these are new. The fauna assemblage is dominated by five species: a vestimentiferan (*Ridgeia* sp.), a limpet (*L. fucensis*), two snails (*D. globulus* and *P. variabilis*) and a polychaete (*A. galapagensis*).

Core was recovered from five holes (Holes 858A, 858B, 858C, 858D, and 858F) at Site 858 that were drilled along a transect across an active vent field (Fig. 4) (AAV, Site 858; Davis, Mottl, Fisher, et al., 1992). None of the holes cored an active vent, although Hole 858B

Figure 4. Map of the Area of Active Venting showing the limits of the acoustically reflective area, active vents and mounds, faults, and Site 858 drill hole positions. Dashed line indicates profile shown in Fig. 5.

was collared near the summit of a sediment mound within 10 m of anhydrite chimneys that were venting 276°C hydrothermal fluids. In Hole 858B, two beds of green saponitic sediment were intersected within 2 m of the seafloor, and a sulfide-anhydrite bed less than 0.5 m thick was cored between 10 and 12 mbsf. The saponitic sediment is texturally and chemically similar to hydrothermal sediment intersected in shallow cores from the AAV (Goodfellow et al., 1993). Both the saponite and sulfide beds occur within hemipelagic silty clay and turbiditic silt. In Hole 858B, hemipelagic sediment is intensely altered to saponite between 20 and 30 mbsf.

Hole 858C was collared within the acoustically reflective area about 100 m west of active vents (Fig. 4) and penetrated unaltered and hydrothermally altered hemipelagic and turbiditic sediments (Fig. 5). Holes 858D and 858F were collared within several meters of each other and about 100 m north of a sediment mound with hydrothermally active chimneys (Fig. 4). These holes intersected weakly altered, hemipelagic and turbiditic sediment (0 to 30 mbsf) that is underlain by lithified, brecciated, fractured, veined, and intensely altered sediment (Fig. 6) in a zone interpreted as major hydrothermal fluid-upflow zone.

Stratigraphy and Sedimentology

Unaltered hemipelagic and turbiditic sediments from Site 858 are similar to sediments recovered at Site 855 and Hole 857A. The turbidites are characterized by medium- to dark-gray silt and sand beds that commonly display sharp, scoured bases, and which become finer-grained upward to olive-gray hemipelagic silty clay. Most turbidite beds are parallel-laminated and some are cross-laminated. Thicknesses of these beds are highly variable and range from <1 cm to >1 m (Davis, Mottl, Fisher, et al., 1992).

Based on examination of shallow (<12 m) cores, individual beds are laterally continuous across AAV, although the sediment thickness above a "Marker Unit" varies laterally (Goodfellow et al., 1993). The "Marker Unit" is a distinctive medium-gray hemipelagic mud typically less than 10 cm thick and composed of up to six near-horizontal zoophycos worm burrows. Isopach contour maps of sedimentary

Figure 5. Geological cross-section of AAV (Site 858) showing the different hydrothermal alteration zones. Mineralogy of alteration zones is as follows: Zone Ib (quartz-wairakite-epidote-pyrite); Zone IIb (quartz-epidote-chlorite); Zone IIIb (albite-chlorite-illite-pyrite); Zone IVb (anhydrite-illite-pyrite); Zone Vb (calcite-illite-pyrite); Zone VIb (saponite-talc-pyrite).

units above the "Marker Unit" define two areas where sediment thicknesses exceed 500 cm, compared to <400 cm outside the AAV, indicating that the AAV has subsided after deposition of the worm-burrowed "Marker Unit." Based on an average sedimentation rate of 40 cm k.y.⁻¹ for the uppermost 7.5 m of sediment in Middle Valley (Goodfellow and Blaise, 1988; Goodfellow et al., 1993), subsidence in the AAV was initiated as early as 13,000 yr ago. Both areas where sediments thicken correspond to vent fields (Goodfellow and Franklin, 1993). This subsidence likely resulted from the dehydration of sediments in response to heating by upward-migrating hydrothermal fluids. Faulting is a less likely mechanism within AAV because the areas where sediments thicken do not extend north and south along a surface-penetrating fault that is visible on SeaMARC IA images (Goodfellow and Franklin, 1993).

Hydrothermal Reaction Zone (Site 857)

Site 857 is about 3 km south of AAV (Site 858) and 2.2 km west of BH (Site 856) (Fig. 1). Because Holes 857A, 857C, and 857D were drilled within 200 m of each other, they are considered to represent a composite stratigraphic section of Site 857 to a depth of 936.2 mbsf. This composite section consists of interbedded hemipelagic and tur-

biditic sediment between 0 and 471.1 mbsf and intercalated mafic sills and hydrothermally altered hemipelagic and turbiditic sediment from 471.1 to 936.2 mbsf (Davis, Mottl, Fisher, et al., 1992). The intensely altered nature of sills and sediment between about 471 and 936 mbsf indicates that they have reacted extensively with hydrothermal fluid.

Stratigraphy and Sedimentology

The stratigraphy of Site 857 comprises four lithostratigraphic subdivisions (Davis, Mottl, Fisher, et al., 1992). Unit I consists of Holocene to Late Pleistocene hemipelagic sediment with minor fine-grained turbidite beds; Unit IIa is composed of non- or weakly-indurated hemipelagic and turbiditic sediments; Unit IIb is similar to Unit IIa but is moderately to well-indurated; and Unit IIc consists of hydrothermally altered hemipelagic and turbiditic sediments intercalated with mafic igneous sills (Davis, Mottl, Fisher, et al., 1992). Hemipelagic sediment is olive-green to gray in color and weakly bedded and bioturbated. Turbidite beds are medium to dark gray in color, variable in grain size and thickness, typically display sharp and commonly scoured bases, are either parallel- or cross-laminated, and fine upward to hemipelagic silty clay.

Figure 6. Stratigraphic section of Holes 858D and 858F showing the general sedimentology, structures, textures, and alteration mineralogy.

PETROGRAPHY AND MINERALOGY

Unaltered Sediment

X-ray diffraction analyses of bulk turbiditic sediment indicate the presence of the following minerals in order of decreasing abundance: quartz, plagioclase, muscovite, chlorite, amphibole, and minor biogenic calcite (Goodfellow et al., 1993; Leybourne and Goodfellow, this volume). In addition, turbiditic sand and silt generally contain minor amounts of epidote, magnetite, zircon, sphene, and apatite. Quartz examined by scanning electron microscopy (SEM) occurs as equant, abraded grains, whereas feldspar grains are equant to elongate. Detrital feldspars consist of plagioclase, K-feldspar, and minor albite. The Ca content of plagioclase is variable and ranges up to 30 mol% CaO (Leybourne and Goodfellow, this volume). Chlorite and muscovite, the most common phyllosilicates, occur as irregular grains or as clusters of ragged flakes that are detrital in origin. Chlorite analyzed by scanning electron microscope-energy dispersive analyses (SEM-EDX) has a Mg/Fe weight ratio less than 1.0 (Leybourne and Goodfellow, this volume).

Hemipelagic silty clay consists of foraminifers, diatoms, radiolarians, nannofossils, detrital quartz, plagioclase, muscovite, chlorite and amphibole, and authigenic clay. The <2 μm fraction contains, in order of decreasing abundance, chlorite, illite, feldspar, amphibole, and quartz (Goodfellow and Blaise, 1988; Goodfellow et al., 1993; Leybourne and Goodfellow, this volume).

Holocene sediments are relatively rich in smectite and irregular mixed-layer clay compared to Late Pleistocene sediments, which contain a higher proportion of sedimentary chlorite and illite. Patches and disseminations of black diagenetic monosulfide occur throughout hemipelagic sediment and are most abundant in intervals rich in biogenic components.

Bent Hill (Site 856)

The alteration mineralogy and mineral chemistry are described by Leybourne and Goodfellow in a companion chapter in this volume. Alteration minerals are zoned vertically within holes and laterally between holes, from high-temperature assemblages (up to 338°C; Peter et al., this volume) near the base of Hole 856B to lower temperature assemblages near the top, and from generally higher temperature assemblages in Hole 856B to lower temperature assemblages in Hole 856A. The temperature of hydrothermal alteration decreases, therefore, away from the massive sulfide mound near the southern margin of BH (Fig. 3).

Five hydrothermal alteration zones have been recognized in Holes 856A and 856B; these are described below (refer also to Leybourne and Goodfellow, this volume; Fig. 7). The roman numerals increase from the core to the margins of the upflow zone, and the letter indicates the area (e.g., a = BH; b = AAV; c = Site 857).

Zone Ia-1

(Quartz-Chlorite-Muscovite-Rutile-Pyrrhotite-Chalcopyrite)

This zone is characterized by silicification, brecciation, and sulfide veining near the base of Hole 856B (Fig. 7). In places, the sediments are bleached pale gray due to the addition of hydrothermal quartz. Biogenic carbonate and most of the organic matter have been destroyed by alteration processes. Fluid inclusion temperatures measured in hydrothermal quartz range up to 338°C (Peter et al., this volume). Pyrrhotite and chalcopyrite are the dominant sulfides, although minor sphalerite occurs locally.

Zone Ia-2 (Quartz-Chlorite-Smectite-Feldspar)

This zone forms a narrow (8–10-m-wide) interval of silicified, chloritized, and demagnetized sediment at the base of Hole 856B. It is distinguished from Zone Ia-1 by generally lower contents of quartz and

sulfides and higher Mg/Fe ratios in chlorite (Leybourne and Goodfellow, this volume). Magnetite, biogenic carbonate, organic matter, and detrital feldspar have been destroyed. Euhedral to subhedral pyrite forms concretions and ubiquitous fine-grained disseminations.

Zone IIa (Albite-Chlorite-Muscovite-Pyrite)

This zone occurs between 70 and 110 mbsf in Hole 856B. The hemipelagic sediment consists of dark gray and indurated silty claystone. Detrital feldspars are albitized and chloritized. Euhedral to subhedral pyrite forms concretions and occurs as fine-grained disseminations between detrital grains. Magnetite, biogenic carbonate, and organic matter have been destroyed.

Zone IIIa (Anhydrite-Illite-Pyrite)

Zone IIIa occurs between 30 and 70 mbsf in Hole 856B (Fig. 8) and between 82 and 114 mbsf in Hole 856A (Fig. 9). This zone consists of anhydrite molds, hydrothermal clay, euhedral to subhedral pyrite, and barite. The molds are similar in morphology and size to tabular anhydrite. The high sulfate content of pore fluids from this zone indicates that not all the authigenic anhydrite has dissolved (Davis, Mottl, Fisher, et al., 1992). The hydrothermal clay is morphologically and compositionally similar to Mg-rich smectite described in shallow cores from the AAV (Goodfellow et al., 1993).

Zone IVa (Calcite-Illite-Pyrite)

This zone does not occur in Hole 856B due to the truncation of altered sediments by a major slump of bedded massive sulfides and interbedded hemipelagic sediment (Figs. 7 and 8). However, an alteration assemblage of calcite, disseminated subhedral to euhedral pyrite, and Mg-rich smectite does occur between 15 and 82 mbsf in Hole 856A (Fig. 9). Calcite occurs as concretions up to several cm across, cemented worm burrows, and carbonate cement. Mg-rich smectite replaces hydrothermal sediment and infills interstices between detrital grains.

Area of Active Venting (Site 858)

Six hydrothermal alteration zones have been recognized in cores from Site 858 (Fig. 6; see also Leybourne and Goodfellow, this volume; Peter et al., this volume). The alteration minerals are zoned laterally and vertically about a moderate-temperature (260° to 300°C) inner core near active vents to a low-temperature (<100°C) outer zone. The characteristic mineral assemblages are described below proceeding from the core to the outer margins of the zones of hydrothermal fluid upflow.

Zone Ib (Quartz-Wairakite-Epidote-Pyrite)

Zone Ib is restricted to the core of the upflow zone and was intersected in Holes 858F between 28 and 120 mbsf, and 142 and 173 mbsf (Fig. 5). This hole penetrated a high-standing volcanic structure at about 250 mbsf (Davis, Mottl, Fisher, et al., 1992). The sediments here are indurated, brecciated, fractured, veined, and variably replaced by hydrothermal minerals. Hydrothermal minerals consist of intergrown euhedral to subhedral quartz, wairakite, epidote, pyrite, and minor sphalerite. Detrital quartz is commonly overgrown by secondary quartz, and the clay minerals are recrystallized (Leybourne and Goodfellow, this volume).

Zone IIb (Quartz-Chlorite-Epidote-Pyrite)

This zone occurs between 120 and 142 mbsf, and 173 and 249 mbsf in Hole 858F (Fig. 6). The sediment is lithified and locally fractured, brecciated, and veined. Alteration minerals are quartz, chlorite, and epidote. Quartz forms overgrowths on detrital quartz grains,

Figure 7. North-south profile of Bent Hill (Site 856) and sulfide mounds showing the distribution of hydrothermal alteration about the Bent Hill massive sulfide deposit. Hold positions are also shown. Profile location shown in Fig. 3. Mineralogy of alteration zones is as follows: Zone Ia-1 (quartz-chlorite-muscovite-rutile-pyrrhotite-chalcopryrite); Zone Ia-2 (quartz-chlorite-smectite-feldspar); Zone IIa (albite-chlorite-muscovite-pyrite); Zone IIIa (anhydrite-illite-pyrite); Zone IVa (calcite-illite-pyrite).

whereas chlorite and epidote replace detrital feldspars. Euhedral pyrite commonly replaces magnetite and amphibole and occurs between detrital grains. Anhydrite-pyrite-chalcopryrite veins locally crosscut this zone.

Zone IIIb (Albite-Chlorite-Pyrite)

Zone IIIb occurs between 175 and 320 mbsf in Hole 858A (Fig. 10) and between 34 and 92 mbsf in Hole 858C (Fig. 11). This zone consists of hydrothermally indurated and brecciated hemipelagic and turbiditic sediment that is locally cut by anhydrite veins. Alteration minerals are albite (after plagioclase), chlorite (after K-feldspar), and euhedral pyrite (after magnetite and amphibole). Euhedral pyrite also occurs disseminated throughout hemipelagic sediment and in the interstices between detrital mineral grains. Zone IIIb is texturally and mineralogically similar to alteration Zone IIa at BH.

Zone IVb (Anhydrite-Illite-Pyrite)

Zone IVb occurs above Zone IIIb in Holes 858A (Fig. 10) and 858C (Fig. 11) and consists of moderately indurated, medium- to dark-gray hemipelagic and turbiditic sediment. Anhydrite forms authigenic pale-gray to white, randomly oriented tabular crystals and white, sub-

rounded concretions that occur throughout hemipelagic sediment. Authigenic illite and euhedral to subhedral pyrite occur throughout Zone IVb. Pyrite replaces detrital magnetite, forms concretions, and occurs as disseminations throughout hemipelagic sediment.

Zone Vb (Calcite-Clay-Pyrite±Barite)

Zone Vb occurs at shallow depths within Holes 858A (Fig. 10), 858C (Fig. 11), and 858D (Fig. 6). Hemipelagic sediment is weakly indurated except where it is locally brecciated and clasts are cemented by calcite. Calcite also forms irregular concretions up to 8 cm in diameter; these occur above the more massive carbonate units in Hole 858C (Fig. 11). Euhedral to subhedral pyrite replaces worm burrows and occurs as disseminations throughout silty clay and between detrital grains in turbidite beds.

Zone VIb (Saponite-Pyrite)

Zone VIb occurs between 24 and 38 mbsf in Hole 858B (Fig. 12), which is collared near active vents (Fig. 4). This sediment consists of pale gray, brecciated hemipelagic silt clay that has been intensely altered to saponite and euhedral pyrite. Quartz and anhydrite line vugs and form veins that crosscut sedimentary layers.

Figure 8. Stratigraphic section of Hole 856B showing the general sedimentology, structures, textures, hydrothermal minerals, and alteration zones.

Reaction Zone (Site 857)

Hole 857A consists mainly of unaltered, weakly indurated, fine-grained hemipelagic and turbiditic sediments that have undergone diagenesis and burial metamorphism. In Hole 857C, however, the hemipelagic and turbiditic sediments are increasingly hydrothermally altered to a depth of 570 mbsf (Fig. 13). Four alteration zones have been recognized: Zone Ic and IIc (quartz-wairakite-epidote-chlorite; 450–936 mbsf, Holes 857C and 857D); Zone IIIC (albite-chlorite-pyrite; 300–450 mbsf, Hole 857C); and Zone IVc (calcite±dolomite-clay-pyrite; 60–300 mbsf, Hole 857C). Mineralogical changes include the breakdown of Fe-bearing phases, reduction of all Fe^{3+} to Fe^{2+} , recrystallization of clay minerals, and precipitation of subhedral to euhedral pyrite. Calcite concretions and cement occur between 60 and 380 mbsf, whereas dolomite is restricted to between 80 and 120 mbsf (Leybourne and Goodfellow, this volume). A plot of bulk CaO

vs. CO_2 shows that most samples containing >0.2 mole percent CaO and CO_2 plot near a line representing stoichiometric calcite or dolomite (Fig. 14). Between 240 and 340 mbsf, detrital plagioclase is albitized. Below about 420 mbsf, detrital K-feldspar, illite, mica, and plagioclase in hemipelagic and turbiditic sediment are hydrothermally altered to epidote, wairakite, albite, and quartz (Leybourne and Goodfellow, this volume). In some samples, intense epidotization has imparted a pale green color to the rock. Wairakite occurs in veins and vugs and interstitially within turbiditic silt and sand.

GEOCHEMISTRY

Unaltered Sediment

Chemical analyses of bulk sediment are given in Table 1 (located at the end of this chapter). Descriptive statistics for unaltered hemipelagic silt clay and turbiditic silt and clay are presented in Table 2.

Figure 9. Stratigraphic section of Hole 856A showing the general sedimentology, structures, textures, hydrothermal minerals, and alteration zones.

The frequency distribution for some elements is skewed due to anomalously high contents of several transition metals in a few oxidized samples from the upper surface layer. Four broad element groups have been defined for Middle Valley regional hemipelagic and turbiditic sediment using R-mode factor analysis. Group 1 consists of Al_2O_3 , TiO_2 , Fe_2O_3 , MgO , P_2O_5 , K_2O , Sr , Rb , Cr , Nb , La , and Y . These elements reside in the detrital component of hemipelagic sediment that consists mostly of illite, muscovite, chlorite, titanite, and apatite. These elements display statistically significant covariations with correlation coefficients between 0.5 and 0.75 at the 95% confidence level. Group 2 consists of SiO_2 , Al_2O_3 , Na_2O , CaO (noncarbonate), and Zr . These elements are enriched in detrital quartz, feldspar, and zircon in turbiditic sand and silt. The bulk chemical composition of these sediments is, in part, controlled by the abundance of detrital minerals, which is dependent on the grain size and style of sedimentation. Sediment compositions vary over a spectrum from sand to clay because turbidites commonly fine upward into hemipelagic sediment. The control of detrital mineralogy on the bulk chemical composition

is illustrated by plots of Al_2O_3 , K_2O , MgO and Zr vs. SiO_2 for silty clay, sand, and silt (Fig. 15). A downhole plot of $\text{Si}:\text{Al}$ ratios (Fig. 16) effectively discriminates between turbiditic intervals characterized by high ratios and hemipelagic sediment characterized by low ratios. Within turbiditic units, ratios commonly increase upward as the proportion of clay minerals increases relative to detrital quartz.

Group 3 is represented by CaO , CO_2 , Sr , and MnO that occur mostly in foraminiferal carbonates. Group 4 elements include most of the transition metals (e.g., Zn , Cu , Ni , Co , V , Se , As , Sb , Mn , and Fe) that are enriched in the brown, oxidized surface layer. Organic C and Ba are also enriched in this surface layer. The transition metals either form Fe and Mn oxyhydroxides or are sorbed to the surfaces of these minerals. The positive correlation of most transition metals with organic C most likely reflects the high content of organic matter in the oxidized surface layer, and the coupled reactions of bacterial organic C oxidation and Fe reduction with depth during diagenesis (Berner, 1984; Goodfellow et al., 1993). The inverse correlation of FeO with Fe_2O_3 (Goodfellow et al., 1993) indicates that Fe^{3+} was reduced to Fe^{2+} during diagenesis. Elements sorbed onto oxyhydroxide surfaces and released to pore waters during the dissolution of Fe and Mn oxyhydroxides diffuse upwards and are partly resorbed to oxidized surface sediments, or are precipitated with diagenetic sulfides (Tsunogai et al., 1979; Berner, 1984).

Moreover, below the brown oxidized layer, most of the transition metals are more concentrated in silty clay than in coarser-grained turbidites due to the higher proportion of pelagic organic matter in the former. Most of the elements bound by organic matter were probably released to pore water by the bacterial oxidation of organic matter during diagenesis, and fixed as iron monosulfide by sulfide formed by the bacterial reduction of dissolved sulfate (Berner, 1984). Amorphous monosulfides are commonly converted to pyrite by reaction with bacteriogenic sulfide generated deeper in the sedimentary sequence.

Hydrothermal Alteration

Bent Hill (Site 856)

Downhole profiles of element abundances are used to illustrate the chemical variability within zones and chemical changes across alteration facies. These plots were constructed using the analyses in Table 1 (located at the end of this chapter) and in Davis, Mottl, Fisher, et al. (1992).

Hole 856B

Chemical profiles for Hole 856B are presented in Figures 17A, B, and C. SiO_2 , Al_2O_3 , and TiO_2 fall within the range of unaltered hemipelagic sediment except between 18 and 25 mbsf, where massive sulfides occur, and below 110 mbsf in Zones Ia-1 and Ia-2, where SiO_2 generally increases and Al_2O_3 and TiO_2 decrease, due in part to the dilution effect of hydrothermal quartz. In general, FeO increases and Fe_2O_3 concomitantly decreases with depth due to the sulfidation of Fe in detrital magnetite and amphibole. The sulfidation of iron in detrital minerals is reflected by major increases of sulfide S and Fe^{2+} throughout Hole 856B. Fe_2O_3 does not, however, increase except near the base of the hole where highly silicified sediment is cut by pyrrhotite and chalcopyrite veins. Zinc, Se, and Mo are elevated relative to unaltered sediment (Table 3) and are associated with high Cu values (>5000 parts per million [ppm]) in Zone Ia-1. Arsenic, Sb, and Be are depleted relative to unaltered sediment (Table 3) in Zones Ia-1 and Ia-2.

Elements bound in biogenic carbonate, namely CaO , CO_2 , and Sr , decrease downhole to a depth of about 40 mbsf and remain uniformly low to the bottom of the hole. MgO , however, increases systematically to a depth of 108 mbsf, below which it decreases (Zone Ia-1) and then increases (Zone Ia-2). High MgO contents reflect Mg-rich chlorite in Zone IIIa and Mg-rich clay in Zone IVa (Leybourne and Goodfellow, this volume). Increases in MgO are accompanied by

Figure 10. Stratigraphic section of Hole 858A showing the general sedimentology, structures, textures, alteration mineralogy, and alteration zones.

Figure 11. Stratigraphic section of Hole 858C showing the general sedimentology, structures, textures, alteration mineralogy, and alteration zones.

higher H_2O contents because most of the Mg is bound by hydrated clays. MnO , which is bound mostly in chlorite, reaches maximum values in Zone IIa. Na_2O decreases steadily in Zone IIIa to a depth of 63 mbsf, except where bedded sulfides occur, and then increases in Zone IIa. Na_2O decreases markedly in Zones Ia-1 and Ia-2. Low Na_2O contents in Zone IIIa correspond to high K_2O associated with illite alteration; high Na_2O is due to the albitization of detrital plagioclase. Because Ba is a common minor element in K-feldspar, the hydrothermal breakdown of feldspar in Zones Ia and IIa is reflected by a marked decrease in Ba below 65 mbsf.

Organic C decreases systematically with depth to values <0.2 weight percent (wt%) within Zones IIa and Ia. This decrease is probably caused by the thermal catalysis of organic matter at high temperature (Simoneit, 1984). The occurrence of hydrothermal bitumen in barite chimneys from Middle Valley indicates that organic matter is cracked by hydrothermal fluids at temperatures in excess of $300^\circ C$ (Simoneit et al., 1992). A ^{14}C age of 29,000 aBP for this bitumen indicates that the source of carbon is immature sedimentary organic matter from shallow depths in the sedimentary sequence (<12 m based on average sedimentation rates of 40 cm k.y.^{-1} , per Goodfellow et al., 1993).

Hole 856A

Hemipelagic and turbiditic sediments in Hole 856A are less altered than similar sediments in Hole 856B. The contents of most elements generally fall within the range of unaltered turbiditic and hemipelagic sediments (Table 2). The large downhole variability of many of these elements (Figs. 18A, B, and C) is controlled by detrital sediment compositions (i.e., silt vs. silty clay) and the dilution effect of calcite concretions and cement in Zone IVa. The higher CaO and CO_2 contents between 15 and 82 mbsf (Zone IVa) are accompanied by higher MgO, H_2O and S contents because of the co-occurrence of Mg-rich smectite and pyrite. Fe_2O_3T does not increase, although Fe^{2+}/Fe^{3+} ratios and S increase systematically with depth due to the hydrothermal reduction and sulfidation of iron in magnetite and amphibole as in Hole 856B. Downhole variations of MnO, Cu, As, Sb, and Se are controlled mostly by sediment type, except in Zone IVa, where these elements are concentrated in carbonate concretions. The manganese substitutes for Ca in calcite whereas the chalcophile elements occur as sulfides in concretions. In unaltered sediment, the chalcophile elements form diagenetic sulfides, which are more abun-

Figure 12. Stratigraphic section of Hole 858B showing the general sedimentology, structures, textures, alteration mineralogy, and alteration zones.

dant in hemipelagic sediment relative to turbiditic sediment as a result of higher contents of more readily metabolized organic matter and lower sedimentation rates.

Area of Active Venting (Site 858)

Hole 858A

Hole 858A intersects unaltered hemipelagic sediment through alteration Zones Vb, IVb, and IIIb towards the center of hydrothermal-fluid upflow at Site 858 (Fig. 5). CaO, CO₂ and MnO display erratic increases in Zone Vb due to the presence of calcite concretions and cement (Figs. 19A, B, and C) and decrease downhole in Zone IVb. FeO and Fe₂O₃ behave antithetically with depth due to the reduction and sulfidation of iron bound in magnetite and other detrital minerals such as amphiboles, epidote, and chlorite. The sulfidation of iron is reflected by an increase in pyrite and sulfide S in all alteration zones in Hole 858A. Fe₂O₃T falls within the range of unaltered sediments and indicates minimal Fe addition by hydrothermal processes.

MgO contents are within the range of values for unaltered sediment (Table 2) from 0 to 120 mbsf and exceed values for unaltered

sediment between 120 and 300 mbsf. High MgO contents correspond to the alteration of K-feldspar and mica by saponite in Zone IVb, and by Mg-rich chlorite in Zone IIIb. This replacement of saponite and chlorite results in an inverse correlation between MgO and K₂O with depth in Hole 858A. H₂O(T) covaries with MgO because of the occurrence of hydrated silicates such as Mg-smectite in Zones IVb and IIIb. High Na₂O contents between 190 and 300 mbsf are controlled by the albitization of plagioclase in Zone IIIb (Leybourne and Goodfellow, this volume).

Barium abundances in saponitic sediment near the seafloor and within Zone VIb exceed those in unaltered sediment (Table 3). Between 75 and 300 mbsf (Fig. 19), Ba decreases relative to unaltered sediment due to the chloritization of K-feldspar and muscovite. Strontium decreases with depth between 0 and 50 mbsf to less than 200 ppm, except for several anomalously high values between 50 and 300 mbsf. Low Sr contents below 50 mbsf are due to the hydrothermal dissolution of foraminifers. The hydrothermal destruction of microorganisms is also reflected by lower organic C contents in Zone IIIb (Fig. 19). Arsenic, Sb, and Se contents are erratic but are generally elevated relative to unaltered sediments throughout Hole 858A (Table

2). The highest abundances of these elements occur in saponitic sediment near the seafloor and in alteration Zone Vb. Most of the remaining elements fall within the range of hemipelagic and turbiditic sediments (Table 3), except where sedimentary minerals have been significantly diluted by hydrothermal carbonate in Zone Vb.

Hole 858B

MgO, MnO, and Mo contents increase downhole (up to 30 wt% MgO at 28 mbsf), whereas Na₂O, K₂O, CaO, CO₂, Sr, Rb, and Ba decrease with depth (Figs. 20A, B, and C). Most of these chemical changes reflect the formation of saponite at the expense of detrital feldspar and mica and the hydrothermal dissolution of biogenic carbonate. The marked decrease of lithophile element contents between 10 and 14 mbsf reflects the dilution of detrital minerals by sulfides and anhydrite. Below 14 mbsf SiO₂, TiO₂, Al₂O₃, Be, Co, and V decrease slightly with depth, probably due to dilution by hydrothermal saponite. The chalcophile elements Cu, Pb, Zn, Ag, As, Sb, and Se are highly enriched in the sulphide-anhydrite bed; these elements are generally elevated relative to unaltered sediment throughout most of Hole 858B (Fig. 20).

Hole 858C

The addition of hydrothermal calcite in Zone Vb is reflected, in part, by marked increases of CaO, CO₂, MnO, Ba, Zn, As, Sb, Pb, Se, and Mo (Figs. 21A, B, and C), and decreases in lithophile elements due to dilution. The chalcophile elements and Ba form sulfides and barite, respectively, that coexist with hydrothermal carbonate. Below Zone Vb to a depth of 76 mbsf the SiO₂ content is generally greater than for unaltered hemipelagic sediment, whereas Al₂O₃, TiO₂, and Fe₂O₃T fall within the range for unaltered sediment (Table 2; Fig. 21A). This SiO₂ increase corresponds to quartz precipitated from hydrothermal fluids. The increase of FeO and decrease of Fe₂O₃ with depth results from the reduction of iron and the formation of hydrothermal pyrite (as in Hole 858A). The formation of pyrite is reflected by high contents of reduced S in all alteration zones in Hole 858C (Fig. 21).

The K₂O and Rb contents are erratic in Zone IVb between 18 and 45 mbsf, but they generally exceed values for unaltered hemipelagic sediment, whereas Na₂O contents are generally lower than for unaltered sediment (Table 3). MgO increases with depth within Zone Vb and is also high in the underlying Zone IIIb. The antithetic behavior of MgO and K₂O with depth is governed by the hydrothermal replacement of K-feldspar and K-mica by chlorite and saponite. CaO contents range between 2 and 5 wt% in Zone Vb and decrease to values below 2 wt% in Zone IIIb. CO₂ contents approach zero and Sr decreases to less than 200 ppm at depths greater than 18 mbsf because of the hydrothermal dissolution of biogenic carbonate, except for isolated high values that coincide with the presence of calcite and anhydrite veins (Fig. 12). The decrease of CaO in Zone IIIb results from the combined effects of calcite dissolution and albitization of detrital plagioclase (Leybourne and Goodfellow, this volume).

Arsenic, Sb and Se contents are highly erratic and are generally enriched relative to unaltered hemipelagic and turbiditic sediments at depths between 18 and 78 mbsf in Zones IVb and IIIb (Table 3). Abundances of the remaining elements fall within the range for unaltered hemipelagic and turbiditic sediment, except for sediment samples that have been diluted by additions of hydrothermal minerals in veins and in the massive carbonate-cemented zone.

Holes 858D and 858F

SiO₂ contents increase with depth to >70 wt% at 49 mbsf and are above average values for hemipelagic sediment to a depth of 230 mbsf (except for one pyrite vein at 132.9 mbsf) (Fig. 22A). Near the base of the hole at about 250 mbsf, SiO₂ contents are typical of unaltered

Table 2. Summary statistics for bulk chemical data for unaltered hemipelagic and turbiditic sediments, Holes 857A, 855A, 855B, and 855C.

Wt%:	Silty claystones (n = 43)					Sand and silt (n = 23)				
	Mean	Med	Min	Max	C.V.	Mean	Med	Min	Max	C.V.
SiO ₂	53.6	54.1	49.0	55.9	0.035	60.8	60.4	58.1	65.2	0.04
TiO ₂	0.84	0.81	0.63	0.97	0.08	50.8	0.83	0.71	0.93	0.063
Al ₂ O ₃	15.8	15.9	12.6	17.7	0.062	15.1	15.0	13.4	16.8	0.06
Fe ₂ O ₃ T	7.90	7.80	6.70	11.8	0.113	6.41	6.50	4.90	8.50	0.13
Fe ₂ O ₃	3.05	3.10	1.70	5.30	0.486	3.03	3.10	1.70	5.30	0.22
FeO	4.22	4.15	3.20	5.60	0.460	4.32	4.20	3.20	7.60	0.21
MnO	0.12	0.12	0.09	0.21	0.207	0.09	0.09	0.07	0.12	0.19
MgO	3.88	3.84	3.12	4.70	0.105	3.10	3.12	2.21	4.08	0.16
CaO	4.78	4.19	2.70	8.83	0.355	3.98	4.06	2.35	5.26	0.17
Na ₂ O	2.24	2.22	1.12	3.50	0.136	2.82	2.87	2.09	3.51	0.19
K ₂ O	2.16	2.20	1.81	2.91	0.114	1.86	1.78	1.34	2.71	0.20
H ₂ O ^T	4.20	4.30	2.50	5.67	0.175	3.01	3.10	1.70	4.36	0.27
P ₂ O ₅	0.19	0.19	0.13	0.24	0.108	0.20	0.19	0.16	0.22	0.08
S	0.27	0.20	0.08	0.94	0.64	0.28	0.20	0.08	0.94	0.20
CO ₂	1.60	0.90	0.10	4.30	0.73	1.60	1.20	0.10	4.30	0.73
C-org	0.39	0.40	0.20	0.70	0.20	0.30	0.30	0.10	0.73	0.30
(ppm)										
Ba	709	705	470	130	0.20	593	564	410	950	0.21
Be	1.33	1.40	1.20	1.80	0.12	1.41	1.40	0.70	1.80	0.140
Co	22	23	16	29	0.16	24	24	16	49	0.23
Cr	83	82	53	110	0.13	88	86	68	111	0.14
Cu	55	55	40	75	0.12	36	38	20	50	0.24
La	17	17	13	27	0.19	18	17	13	27	0.19
Nb	11	11	5	16	0.14	12	11	7	18	0.22
Ni	58	57	42	76	0.15	45	48	28	63	0.96
Rb	71	70	50	110	0.19	58	56	30	157	0.44
Sc	16	17	13	20	0.10	18	18	13	35	0.19
Sr	343	338	236	480	0.17	350	350	222	440	0.18
V	138	140	100	199	0.09	128	130	100	168	0.16
Y	20	20	17	24	0.07	20	20	17	25	0.11
Yb	1.74	1.90	1.6	2.2	0.09	1.93	1.90	1.60	3.80	0.19
Zn	119	110	91	420	0.47	82	83	49	122	0.24
Zr	118	120	83	191	0.13	172	169	130	270	0.18
Se	0.69	0.89	0.40	2.76	0.51	0.54	0.50	0.10	1.24	0.63
Sb	5.73	0.64	0.24	1.31	0.41	0.40	0.35	0.21	0.67	0.36
As	1.01	4.97	2.39	13.9	0.41	7.02	7.03	3.27	15.3	0.37

Note: med = median; C.V. = coefficient of variation; wt% = weight percent; ppm = parts per million; FeO₃T = total iron expressed as Fe₂O₃; H₂O^T = total water content of the sample after drying of the sample.

hemipelagic and turbiditic sediment (Table 2). Al₂O₃, Fe₂O₃T, P₂O₅, and TiO₂ contents of most samples between 49 and 129 mbsf are less than those for unaltered hemipelagic sediment because of the dilution effect of hydrothermal quartz. Ferric Fe (expressed as Fe₂O₃) decreases with depth to <0.2 wt% at 22.6 mbsf, remains low between 22.6 and 114.0 mbsf and increases slightly between 114 and 249.6 mbsf.

Na₂O contents decrease to <1.0 wt% at 28 mbsf and remain low to 110 mbsf (Zones IVb and Ib) (Fig. 22A). Na₂O values increase below 110 mbsf (Zone IIb) because of the albitization of detrital plagioclase (Leybourne and Goodfellow, this volume). The low Na₂O contents in Zone Ib result from the replacement of albite by Ca-plagioclase and wairakite. CaO decreases downhole within Zone IVb due to the hydrothermal dissolution of biogenic carbonate. Below Zone IVb, CaO behaves inversely to Na₂O due to the replacement of albite by Ca-plagioclase and wairakite in Zone Ib. MgO contents increase with depth in Zones Vb and IVb due to the formation of Mg-rich clay minerals and are greater than for unaltered sediment in Zone Ib. In Zone Ib, however, the MgO content is generally less than in unaltered sediments.

K₂O increases with depth in Zone Vb and is uniformly high in Zone IVb as a result of the formation of mixed layer illite-smectite. The marked decrease of K₂O to <1.0 wt% at depths >30 mbsf is governed by the hydrothermal alteration of K-feldspar and mica to chlorite, plagioclase, and wairakite. Rb, Ba, CO₂, Cu, Zn, As, Sb, Se, and Sr also decrease markedly below 28 mbsf. Above 28 mbsf within Zone IVb there is a major increase in Zn, Ba, As, Sb, Se, Mo, and S (Fig. 22B). Nickel and V contents are highly variable with depth, but these elements generally covary (Fig. 22B).

Hydrothermal Reaction Zone (Site 857)

The downhole chemical variations in Holes 857A, 857C, and 857D are presented in Figures 23A, B, and C. SiO₂ generally ranges between 50 and 70 wt%, except for samples with carbonate concretions where

Figure 13. Stratigraphic section of Hole 857C showing the general sedimentology, structures, textures, alteration mineralogy, and alteration zones.

Figure 13 (continued).

the silica content is diluted by calcite and dolomite. Below about 550 mbsf in Holes 857C and 857D (Zones Ic and IIc), SiO_2 increases to values >70 wt% because of the addition of hydrothermal quartz, with a concomitant decrease of TiO_2 , Al_2O_3 , Fe_2O_3 , MgO , P_2O_5 , La, Zr, Cr, Co, V, and Y (except for carbonate concretions). TiO_2 values >1.5 wt% at 539.0 and 539.7 mbsf are from samples that are mixtures of mafic sill and sediment. $\text{TiO}_2/\text{Al}_2\text{O}_3$ ratios are relatively uniform and are similar to those for unaltered hemipelagic and turbiditic sediment except locally below 550 mbsf (Fig. 23A), where erratic fluctuations of this ratio suggest that Al and/or Ti have been locally mobilized during hydrothermal alteration.

Na_2O contents increase downhole to a depth of 250 mbsf, remain high to about 500 mbsf (Zone IIIc), and decrease from about 500 to 700 mbsf. Below 700 mbsf Na_2O increases to >3.0 wt% to the bottom of Hole 857D. The high Na_2O contents between 240 and 500 mbsf coincide with the albitization of detrital plagioclase (Leybourne and Goodfellow, this volume) and low Na values of pore water (Davis, Mottl, Fisher, et al., 1992). The low Sr contents between 220 and 405 mbsf probably reflect the albitization of detrital calcic plagioclase.

Below 430 mbsf K_2O decreases to <0.06 wt% because of the replacement of K-feldspar, illite, and detrital mica by epidote, quartz, wairakite, and albite. Rubidium, Ba, Zn, Cu, Be, As, Sb, and Se also display a marked decrease due to the hydrothermal alteration of sedimentary minerals (Fig. 23B). CaO generally decreases to a depth of 320 mbsf due to dissolution of biogenic carbonates, and below this increases erratically to the bottom of Hole 857D. High CaO contents above 500 mbsf correspond to carbonate concretions, whereas below this depth the CaO occurs in wairakite and epidote. Below 500 mbsf CO_2 is <1.0 wt% because of the hydrothermal dissolution of carbon-

ate. Sulfur contents are generally <0.5 wt% at depths between 500 and 615 mbsf, except for isolated high values (Fig. 23), approach 2 wt% between 615 and 735 mbsf due to the presence of pyrite and pyrrhotite veins, and are generally less than values for unaltered sediments (≈ 0.36 wt%; Table 3) below 735 mbsf.

MASS BALANCE CALCULATIONS

Mass changes were calculated using the equation of Gresens (1967) to evaluate absolute chemical changes during hydrothermal alteration of sediments:

$$X_n = W_B - W_A = w[(F_v)(X_B)S_B/S_A] - X_A, \quad (1)$$

where X_n is the change in weight proportion of component n , W_A and W_B are the weights of components n in parent rock A and altered rock B, respectively, w is the initial weight of parent rock, F_v is the volume factor (the ratio of volume of altered rock to parent rock), X_A and X_B are the weight proportions of component n in parent rock A and altered rock B, respectively, and S_A and S_B are specific gravities of parent and altered rocks, respectively.

As suggested by Leitch and Day (1990), by expressing X'_n as the W_B/W_A ratio, Equation 1 is dimensionless, and solving the logarithm of this ratio results in a linear relationship between X'_n and F_v :

$$\log(X'_n) = \log(W_B/W_A) = \log(F_v) + \log[(X_B/X_A) - (S_B/S_A)]. \quad (2)$$

Because there are two unknowns in Equation 2, namely X'_n and F_v , it is possible to determine the relative mobility of elements by choosing values of $\log F_v$ and plotting them against $\log X'_n$ for each sample. Immobile constituents will have common intercepts on $\log F_v$. Because

Table 3. Average composition of hydrothermally altered sediments associated with the BH (Site 856) and AAV (Site 858) fluid upflow zones, and the hydrothermal reaction zone at Site 857.

Wt%:	Bent Hill (Site 856) alteration zones					AAV (Site 857) alteration zone						Site 857 alteration zone	Hole 857A
	Ia-1	Ia-2	IIa	IIIa	IVa	Ib	IIb	IIIb	IVb	Vb	VIb	Ic	Unaltered
SiO ₂	54.5	61.3	61.1	54.3	56.2	67.5	58.4	58.7	57.4	51.8	41.9	63.3	55.85
TiO ₂	0.78	0.71	0.79	0.79	0.78	0.53	0.87	0.81	0.78	0.70	0.60	0.76	0.82
Al ₂ O ₃	15.1	12.9	14.9	14.8	14.5	14.2	15.8	15.0	15.1	13.4	11.2	13.6	14.9
Fe ₂ O ₃ T	10.8	14.3	5.91	8.00	6.5	2.93	7.37	6.73	7.00	6.00	4.89	7.11	7.20
MnO	0.13	0.21	0.34	0.10	0.16	0.43	0.13	0.15	0.11	0.15	0.21	0.14	0.13
MgO	6.22	3.45	6.80	6.37	4.27	2.07	6.73	5.45	5.79	2.82	29.6	4.03	3.82
CaO	1.59	0.25	0.45	0.41	5.37	5.02	1.90	2.73	1.94	9.23	1.54	4.71	4.76
Na ₂ O	0.43	0.08	2.93	1.31	2.46	2.43	4.13	3.72	2.33	1.68	0.68	2.67	2.34
K ₂ O	1.34	1.32	0.89	2.31	1.83	0.14	0.38	2.25	2.34	2.91	0.10	0.05	2.02
H ₂ O ^T	2.81	1.50	2.53	3.71	3.14	2.90	4.22	5.30	4.93	3.86	11.2	3.13	3.69
P ₂ O ₅	0.15	0.15	0.21	0.19	0.22	0.15	0.21	0.20	0.20	0.20	0.04	0.17	0.20
S	1.66	2.31	1.20	1.66	0.06	0.64	0.94	1.64	1.64	1.08	0.82	0.58	0.36
CO ₂	0.0	.009	.006	0.06	2.78	0.0	0.0	0.05	0.48	4.19	0.09	0.05	2.31
C-org	0.06	0.08	0.08	0.28	0.24	0.0	0.09	0.19	0.24	0.27	0.17	0.03	0.37
(ppm)													
Ba	416	427	120	572	504	63	150	204	642	869	55	0.63	600
Be	0.66	0.34	0.78	0.91	0.91	0.57	1.26	1.26	1.38	1.34	0.63	0.87	1.47
Co	22	17	12	14	20	6	21	21	20	16	11	17	19
Cr	67	77	66	85	81	3.1	74	80	80	72	59	88	87
Cu	217	793	526	46	43	33	17	48	40	38	28	27	43
La	15	16	12	13	15	26	16	16	18	18	16	14	18
Nb	9.1	14	15	13	11	17	16	16	15	13	17	11	12
Ni	32	32	28	53	51	18	42	49	51	41	48	35	51
Rb	17	19	18	68	50	11	14	23	65	80	10	6	63
Sc	16	11	11	13	33	9.8	18	16	16	13	9.8	16	22
Sr	97	25	49	71	281	117	177	200	128	202	49	290	318
V	88	116	106	143	116	49	136	124	129	104	92	138	129
Y	17	15	15	19	18	14	17	17	19	18	13	20	20
Yb	1.48	0.98	1.05	1.16	6.23	1.3	1.5	1.6	1.7	1.6	1.1	1.8	2.7
Zn	137	163	93	109	98	21	76	118	132	89	181	76	95
Zr	157	146	148	133	142	120	124	133	127	121	107	147	145
Se	7.08	11	0.33	0.98	0.63	0.67	0.83	1.29	1.11	0.73	1.29	1.77	0.82
Sb			0.22	0.47	0.47		0.27	0.48	0.84	0.94	0.22	0.04	0.45
As	2.68	0.39	4.54	7.63	6.18	2.06	6.52	8.38	12.4	11.7	6.31	1.51	6.60
n	8	8	12	21	31	3	9	30	40	102	8	45	50

Note: Wt% = weight percent; ppm = parts per million; Fe₂O₃T = total iron expressed as Fe₂O₃; H₂O^T = total water content of the sample after drying of the sample; n = number of samples.

Figure 14. Plot of CaO (molecular proportions) vs. CO₂T (molecular proportions) for sediment samples from Holes 857A and 857C.

$\log(X'_n) = 0$ for immobile components, the intercept value of $\log F_v$ is the volume factor for a particular sample. If $F_v > 1$, there was an increase in volume, whereas $F_v < 1$ denotes a volume decrease.

The application of Gresens' equations assumes that unaltered and hydrothermally altered samples are from the same protolith. Although volcanic rocks commonly show little chemical variation within a flow, turbiditic and hemipelagic sediments are highly variable in composition because of the effects of sedimentation on grain size and mineralogy. Thus, the compositions of sediment protolith are highly variable. Turbiditic silt and sand contain greater SiO₂, Na₂O, and Zr, and lower Al₂O₃, MgO, and K₂O contents compared to hemipelagic silty clay (Table 2). It is essential, therefore, that hydrothermally altered sediment be carefully matched to unaltered sediment in Middle Valley before calculating absolute chemical changes.

For hydrothermally altered sediments from Middle Valley, samples were first classified on the basis of texture and grain size using petrographic methods. The chemical mobility of elements was then evaluated using Gresens' technique (Gresens, 1967). Of all the elements determined, TiO₂ and Yb displayed similar F_v values (Table 4) indicating that they behaved similarly during alteration and were, therefore, least mobile. Zirconium also behaved similarly but was not used in the mass balance calculations because it is generally more erratic due to its occurrence as a heavy mineral during sedimentation. Al₂O₃ behaved coherently with TiO₂ and Yb in weakly to moderately altered sediment but was clearly mobilized, at least locally, in intensely altered sediment in the core of both the AAV and BH upflow zones. Because TiO₂, Yb, and Zr are relatively immobile during hydro-

Figure 15. Binary scatter plots of Al_2O_3 , K_2O , MgO , and Zr vs. SiO_2 illustrating the control of grain size on the chemical composition of bulk sediment, Hole 857A.

thermal alteration at Middle Valley, and have been shown to be immobile in other studies (e.g., Winchester and Floyd, 1976; Floyd and Winchester, 1978; Maclean and Kranidiotis, 1987), and their abundances vary systematically with grain-size, they were used to match the sedimentary protoliths of altered and unaltered samples. TiO_2 and Yb are concentrated along with Al_2O_3 in hemipelagic silty clay, whereas Zr , present as zircon, occurs with detrital quartz in turbiditic silt and sand (Fig. 15).

The absolute weight changes between parent sediment and a representative sample of each alteration zone ($W_A - W_B$) (Table 4) were calculated using the computer program GRES (Leitch and Day, 1990). Table 5 summarizes groups of elements that show major gains or losses in each alteration zone. Zone Ia-1, the inner core of the BH upflow

zone, shows major gains of SiO_2 (32 wt%), Al_2O_3 (8.6 wt%), $\text{Fe}_2\text{O}_3\text{T}$ (13.8 wt%), MgO (3.0 wt%), and S (2.0 wt%) and depletions of CaO (3.5 wt%), K_2O (0.9 wt%) and Na_2O (2.9 wt%). Zone Ia2, which surrounds Zone Ia-1, shows gains of MgO (7.4 wt%) and losses of K_2O (1.7 wt%) and CaO (3.7 wt%). CO_2 and TOC have been depleted in both zones. Zone IIa shows major increases of SiO_2 , MgO , Na_2O and S , and decreases of CaO , K_2O , CO_2 , and TOC . In Zone IIIa, MgO , K_2O , $\text{Fe}_2\text{O}_3\text{T}$, and S increase, and CaO and CO_2 decrease, whereas Zone IVa is enriched in CaO and CO_2 .

At AAV (Site 858), the inner core of the upflow zone (Zone Ib) shows major additions of SiO_2 (51 wt%), Al_2O_3 (3.7 wt%), and CaO (6.4 wt%), and depletions of $\text{Fe}_2\text{O}_3\text{T}$ (3.9 wt%), MgO (2.2 wt%), Na_2O (2.4 wt%), K_2O (1.7 wt%), and CO_2T (1.2 wt%). Zones IIb and

Figure 16. Downhole profile of $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratios for Hole 857A outlining turbiditic intervals characterized by high ratios that decrease upward as the proportion of clay minerals increase at the expense of quartz.

IIIb have generally gained MgO , Na_2O , and Al_2O_3 at the expense of CaO , CO_2 , and K_2O , whereas Zones IVb has gained both MgO and FeO and lost CaO and CO_2 . Zones Vb and VIb show major additions of CaO and MgO , respectively.

At Site 857, Zone Ic of the hydrothermal reaction zone in the sill complex displays gains and losses that are similar to those calculated for Zone Ib in the core of the AAV upflow zone (Table 4). Zone Ic is characterized by major gains of SiO_2 , CaO , and Al_2O_3 , and losses of Na_2O , K_2O , and CO_2 . Zone IIIc, which is characterized by the albite-chlorite-pyrite assemblage in Hole 857C, shows a major increase in Na_2O (1.4 wt%).

The absolute mass changes for most of the remaining elements are <1.0 wt%, although many of these elements display large gains or losses relative to their contents in unaltered parent sediment. Relative element gains or losses, expressed as $\text{Log } W_B/W_A$, (Eq. 2) were calculated using computer program NEWGRES (Leitch and Day, 1990). In Zones Ia-1, IIa, IVa, Vb, and VIb, for example, MnO displays mass gains over unaltered sediment of 350% to 1700% (Table 6). Similarly, Cu displays mass gains of 1300% to 7600% in Zones Ia-1 and Ia-2, but shows losses of 41% to 46% in Zones Ib and Ic. Other elements that display significant mass losses of about 50% or greater in the reaction zone (Zone Ic, Site 857) and the AAV upflow zone (Zone Ib, Site 858) include Ba , Co , Ni , Rb , Zn , Se , and As .

DISCUSSION

Hydrothermal Upflow Zones

Hydrothermally altered sediments at BH are distributed about an inactive massive sulfide mound that is 35 m high and at least 96 m thick (Goodfellow and Franklin, 1993; Davis, Mottl, Fisher, et al., 1992). Pyrrhotite-chalcocopyrite veins that cut brecciated lithified sediment near the bottom of Hole 856B adjacent to the BH sulfide deposit probably represent the core of the hydrothermal-fluid upflow. Away from this intensely altered core, the sediments are progressively less altered. At AAV hemipelagic and turbiditic sediments are similarly zoned from an intensely altered core outward to less altered sediment. The alteration zones have a convex-upward morphology in two dimensions (Fig. 5) that is similar to alteration patterns determined by Goodfellow et al. (1993) and mimics the shape of isopleths of Si , Mg , Ba , and Ca in pore waters in shallow (<10 m) cores from this site (Lydon et al., 1991).

Because sediments nearest centers of fluid discharge at Middle Valley have been hydrothermally lithified, they are commonly fractured and brecciated, producing the high permeability in the core of the upflow zone (Davis, Mottl, Fisher, et al., 1992; C. Rohr, pers. comm., 1993). Near the center of fluid discharge, the permeability is, therefore, mostly controlled by fractures that are lined with hydrothermal minerals. Multiple vein-sets, re-brecciated breccias, and crack-seal textures (Ramsay, 1980) indicate that several episodes of sealing by the precipitation of hydrothermal minerals in open spaces, fluid overpressuring, and subsequent rupturing have occurred. Since the sealing and breaching of the upflow zone most likely occur episodically, there are temporal variations in the lateral migration of hydrothermal-fluids and the entrainment of seawater. Changes in the physical properties of the sediment during hydrothermal alteration would also affect the style and extent of hydrothermal alteration. Highly indurated hemipelagic sediments would deform brittlely in response to hydrofracturing, which would increase the permeability in the high-temperature core of fluid discharge conduits. The precipitation of calcite and pyrite in the grain interstices of turbiditic silt and sand, and the absence of veins cutting hemipelagic sediment indicate that fluids migrated laterally along permeable layers because of the low cross-stratal permeability near the weakly altered margins of the fluid upflow zone (Goodfellow et al., 1993). During periods when fractures are open and fluid discharge is less restricted, however, seawater would probably be entrained into the discharge conduit, resulting in the precipitation of most Mg as Mg -rich silicates. The zone of high fracture-controlled permeability may have propagated upward and expanded outward from the center of fluid upflow over time. Such an expanding hydrothermal front may have produced the mineralogical and chemical zonation documented at BH and the AAV (Leybourne and Goodfellow, this volume). Components that were dissolved from altered sediment near the center of fluid discharge (e.g., Ca , CO_2 , K , Na , Sr , and Rb) migrated upward and outward and were precipitated with hydrothermal components largely originating from end-member hydrothermal fluids (e.g., H_2S , Ba , Zn , As , Se , Sb) near the transition between fractured and highly permeable indurated sediment, and less permeable soft, hemipelagic silty clay.

Bent Hill (Site 856)

Holes 856A and 856B intersected alteration zones north of the BH massive sulfide deposit (Fig. 3). The morphology of the upflow zone and its spatial relationship to the sulfide deposit presently cannot be determined because of the paucity of drill holes. The cross-sectional nature of the upflow zone, however, can be determined from Holes 856A and 856B (Fig. 7). Hemipelagic and turbiditic sediments between 110 and 120 mbsf in Hole 856B are brecciated and crosscut by quartz-sulfide veins (Zone Ia). Open spaces in the hydrothermal breccias are infilled by hydrothermal silicates, mostly quartz, muscovite, and chlorite (Leybourne and Goodfellow, this volume). This

Table 4. Losses and gains ($W_B - W_A$) of elements in hydrothermal alteration zones associated with the BH and AAV fluid upflow conduits, and the reaction zones below 450 mbsf at Site 857.

Gains and losses in weight percent																							
Location	Sample number	Zone	Fv(TiO ₂)	Fv(Yb)	Density (g/cc)	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ Oc	K ₂ O	P ₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC	
Site 856 (Bent Hill)	856A-8H-1, 8–10 cm	IVa	1.21	0.94	2.78	-4	-0.1	-1.7	-0.9	-1.5	0.5	0.23	2.2	6.8	-0.3	-0.7	0.15	0.5	0.3	5.3	5.4	-0.08	
	856B-6H-6, 118–122 cm	IIIa	1.00	1.16	2.77	3	0.1	2.3	1.8	-1.3	6.5	0.09	3.6	-3.4	-1.5	1.2	0.02	2.4	0.8	-0.4	-0.7	0.03	
	856B-13X-4, 128–132 cm	IIa	1.03	1.17	2.92	12	0.1	2.5	0.0	ND	ND	0.61	4.4	-3.3	1.1	-0.9	0.02	1.9	0.8	-1.1	-0.7	-0.18	
	856B-15X-6, 6–8 cm	Ia-2	1.08	1.03	2.80	2	0.0	-0.7	0.1	-0.7	0.8	-0.05	7.4	-3.7	-2.8	-1.7	0.05	4.7	0.8	-1.3	-0.7	-0.19	
	856B-15X-1, 91–93 cm	Ia-1	1.24	1.75	2.84	32	0.2	8.6	13.8	ND	ND	0.28	3.0	-3.5	-2.9	0.9	-0.03	-3.2	2.0	-0.7	-0.7	-0.14	
Site 858 (AAV)	858B-5H-1, 140–143 cm	VIb	1.50	2.27	2.67	17	0.2	1.9	0.5	-0.3	0.8	0.28	48.3	-0.2	-0.6	-1.6	-0.07	15.8	-0.1	0.1	ND	ND	
	858C-3H-1, 78–81 cm	Vb	4.77	4.04	2.70	6	-0.1	1.7	2.9	ND	ND	1.44	0.3	174.0	-1.1	0.7	0.93	-3.2	7.1	141.0	141.0	0.14	
Site 857	858A-18X-3, 14–16 cm	IVb	0.98	0.87	2.86	-7	-0.1	0.8	1.4	-1.4	2.6	0.05	3.9	-2.6	-0.6	-0.3	0.00	2.3	0.2	-0.8	-0.7	-0.11	
	858A-30X-1, 67–70 cm	IIIb	0.90	1.15	2.79	0	0.1	2.5	0.9	-1.8	2.7	0.06	3.1	-2.3	1.2	-0.5	0.04	1.6	0.2	-0.8	-0.7	-0.90	
	858F-25R-1, 19–21 cm	IIb	0.95	1.26	2.70	2	0.1	3.2	1.1	-1.6	2.4	0.07	4.5	-2.0	1.6	-0.9	0.01	2.0	-0.1	-0.8	-0.7	-0.08	
	858F-9R-1, 18–20 cm	Ib	1.75	1.35	2.70	51	-0.1	3.7	-3.9	-1.7	-1.9	-0.04	-2.2	6.4	-2.4	-1.7	0.00	3.2	-0.1	-1.2	-0.7	-0.15	
	857C-21R-3, 27–29 cm	IIIc	1.12	1.17	2.60	6	0.0	2.1	0.9	-0.5	1.2	0.01	0.1	-1.2	1.4	0.1	0.04	0.2	0.0	-0.3	-0.6	0.03	
	857D-17R-3, 23–25 cm	Ic	1.96	1.61	2.82	72	-0.1	5.4	1.2	3.4	-1.8	0.19	-0.4	11.8	-2.7	-1.7	0.00	0.1	0.0	-1.5	ND	ND	
Gains and losses in parts per million																							
Location	Sample number	Zone	Fv(TiO ₂)	Fv(Yb)	Ba	Be	Co	Cr	Cu	La	Nb	Ni	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As
Site 856 (Bent Hill)	856A-8H-1, 8–10 cm	IVa	1.21	0.94	-129	-0.1	0	-19	-14	2	-7	-10	-19	-4	40	-25	5	0.3	15	-8	-0.6	0.00	-1.6
	856B-6H-6, 118–122 cm	IIIa	1.00	1.16	90	0.2	6	4	7	1	7	10	39	3	-252	23	1	-0.1	62	-8	-0.5	0.18	4.7
	856B-13X-4, 128–132 cm	IIa	1.03	1.17	-313	0.1	4	-6	-16	0	10	-7	-25	1	-258	11	0	-0.1	1	3	-0.7	-0.12	-0.1
	856B-15X-6, 6–8 cm	Ia-2	1.08	1.03	-436	-0.6	-16	-91	488	-12	5	-52	-46	-2	-223	-110	-3	0.1	-77	-9.83	0.5	-0.13	-5.7
	856B-15X-1, 91–93 cm	Ia-1	1.24	1.75	193	0.2	14	16	3066	-4	3	-4	3	-11	5	21	5	-0.3	137	21	3.8	-0.08	-4.5
Site 858 (AAV)	858B-5H-1, 140–143 cm	VIb	1.50	2.27	-361	-0.3	-4	19	-22	1	25	16	-33	0	-196	91	-2	-0.3	-25	71	-0.8	-0.06	2.0
	858C-3H-1, 78–81 cm	Vb	4.77	4.04	643	4.0	4	3	25	27	32	-14	22	0	203	57	24	0.2	-2	-23	5.3	4.30	57.0
	858A-18X-3, 14–16 cm	IVb	0.98	0.87	-229	0.1	-1	-25	2	-4	4	2	-8	1	-231	25	3	0.1	17	-44	0.3	-0.14	-4.1
	858A-30X-1, 67–70 cm	IIIb	0.90	1.15	-279	0.1	5	-17	-12	0	7	-9	-12	3	-194	28	-2	-0.2	21	-45	0.1	0.21	7.8
	858F-25R-1, 19–21 cm	IIb	0.95	1.26	-226	0.2	-4	-3	5	-2	6	-12	-29	5	-123	46	0	-0.2	23	-18	1.1	-0.13	-3.2
Site 857	858F-9R-1, 18–20 cm	Ib	1.75	1.35	-413	-0.4	-11	-13	-23	8	19	-30	-37	-4	-219	-38	0	0.3	-51	80	-0.8	-0.09	-5.9
	857C-21R-3, 27–29 cm	IIIc	1.12	1.17	53	0.2	2	-6	-2	1	2	-11	-1	1	-26	0	2	0.0	11	-9	1.6	0.01	-0.8
	857D-17R-3, 23–25 cm	Ic	1.96	1.61	-398	-0.3	-10	-31	-22	1	10	-32	-34	-2	252	-27	2	0.2	-43	53	-0.5	-0.06	-5.6

Notes: Volume factors calculated using TiO₂ and Yb as immobile elements. ND = not determined; Fv = volume factor.

Figure 17A. Downhole profiles of major element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 856B.

Figure 17B. Downhole profiles of minor and trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 856B.

Figure 17C. Downhole profiles of trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 856B.

breccia- and fracture-controlled permeability extends into the overlying alteration zone (Zone IIa) where hemipelagic and turbiditic sediment are also indurated, but are less commonly fractured and veined. In Zone IIIa, which overlies Zone IIa in Hole 856B, hemipelagic sediment is moderately indurated, brecciated, and locally crosscut by veins. The bleaching and silicification of the breccia matrix and the preferential occurrence of pyrite in the matrix over clasts indicates that fluid flow was focussed within the more permeable matrix. This alteration is distinct from the outermost alteration zone (Zone IVa in Hole 856A), which is characterized by weakly to nonindurated sediments that are variably cemented by calcite and which also contain carbonate concretions.

The core of the BH upflow zone is characterized by a high-temperature (up to 338°C; Peter et al., this volume) mineral assemblage consisting of quartz + chlorite + muscovite + rutile + pyrrhotite + chalcocopyrite (Zone Ia-1). These minerals replace detrital and diagenetic minerals in hemipelagic and turbiditic sediments, form veins which cut altered sediment, and infill open spaces within hydrothermal breccias. In Zone Ia-1, detrital K-feldspar and plagioclase are replaced by Fe-rich chlorite and muscovite. This replacement has resulted in the depletion of most alkali elements (Na, Rb, Sr, and Ba) and the addition of Fe and Mg. The occurrence of sulfide veinlets (mostly pyrrhotite and chalcocopyrite) is reflected by marked increases of S, Cu, Se, and Mo. Detrital epidote has been destroyed in this zone. The extent of K addition and Ca depletion in Zone Ia-1 is illustrated by plotting samples from this zone on a ternary ($\text{MgO} + \text{Na}_2\text{O}$) - K_2O - CaO diagram (Fig. 24). Samples from Zone Ia-1 plot along the $(\text{MgO} + \text{Na}_2\text{O})/2$ - K_2O join, away from the field of unaltered sediment and toward K_2O .

Fluid inclusion temperatures measured in quartz range between 181° and 338°C (Peter et al., this volume). These are consistent with temperatures estimated from chlorite compositions (Leybourne and Goodfellow, this volume) and estimated minimum temperatures of 300°C based on Cu and Fe sulfide solubility considerations (Cramer and Barnes, 1976). The rate of precipitation of metals during cooling of a 400°C fluid that had equilibrated with basalt with a fluid/basalt ratio of unity was determined by Seewald and Seyfried (1990). Mn and Zn do not show major changes but Cu and Fe drop off quickly and are therefore more useful in estimating original compositions and temperatures for fluids that have cooled during ascent to the seafloor.

The Fe content of chlorite in Zone Ia indicates that hydrothermal chlorite formed from a Mg-depleted, end-member hydrothermal fluid that was probably similar to high-temperature (>350°C), basalt-equilibrated hydrothermal fluids that vent along nonsedimented oceanic rifts (Edmond et al., 1979; Von Damm, 1990). The primary pyrrhotite-isocubanite-wurtzite assemblage at BH is interpreted to have precipitated from such fluids (Goodfellow and Franklin, 1993). This sulfide assemblage is a common product of high-temperature (>350°C) "black smoker" fluids venting along oceanic rifts (e.g., Francheteau et al., 1979; Goldfarb et al., 1983; Haymon, 1983; Oudin, 1983). Furthermore, the high fracture-controlled permeability, hydrothermal fluid-dominated mineral assemblages and high fluid temperatures (Peter et al., this volume) indicate that the core of the upflow zone was characterized by high hydrothermal water/rock ratios and hydrostatic pressures that exceeded lithostatic pressures.

Zone IIa, which surrounds the inner core (Zone Ia), is characterized by the albitization of plagioclase and the chloritization of orthoclase, illite, and mica. These alteration reactions have caused a depletion in K, Rb, Ba, and Sr and an increase in Mg and Na (Fig. 23). The Mg-metasomatism of sedimentary silicates indicates that unmodified (Mg-rich) seawater was entrained into the upflow zone. Mass balance calculations show that up to 0.13 g/cm³ of Mg have been added to Zone IIa. Using a seawater Mg content of 52.8 mmol/kg for Middle Valley seawater (Butterfield et al., this volume) and assuming that all Mg was precipitated, a minimum water/rock mass ratio of 35.6 is calculated. Mg metasomatism is entirely prograde and occurs predominantly at the margins of the hydrothermal upflow zone. This process

Table 5. Summary of element gains and losses in hydrothermal alteration zones associated with the BH and AAV fluid upflow conduits, and the reaction zones below 450 mbsf at Site 857.

Alteration zone	Mineral assemblage	Elements added	Elements removed
<i>Bent Hill (Site 856)</i>			
Ia-1	Qz-Ch-Ms-Ru-Cp-Po	Si, Fe ^T , Al, Mg, S, K, Mn, Cu, Ba, Zn, Se, Co, Cr	Ca, Na, CO ₂ , TO, As, Sc
Ia-2	Ch-Sm-Fp-Qz	Mg, Fe ²⁺ , Rb, Cu, S, Cu, H	Ca, Na, K, CO ₂ , TOC, Ba, Sr, Zn, Cr, La, Ni, Rb, V, As, Sb
IIa	Ab-Ch-Ms-Py	Si, Mg, Al, H, Na, Mn, S	Ca, K, CO ₂ , TOC, Ba, Sr, Rb, Cu, Sb
IIIa	An-II-Py-Ba	Mg, Fe ²⁺ , Al, K, H, S, Ba, Cu, Zn, As, Sb, Rb, V	Ca, Fe ³⁺ , Na, CO ₂ , Sr
IVa	Ca-II-Py	Ca, CO ₂ , Mg, H, S, Fe ²⁺ , Mn, Sr, Zn	Fe ³⁺ , K, Na, Ba, Cu, As, V, Rb, Cr
<i>Area of Active Venting (Site 858)</i>			
Ib	Qz-Wa-Ep-Py-Sp	Si, Al, Ca, H	Fe ^T , Na, K, CO ₂ , TOC, Ba, Sr, Rb, Zn, As, Cu, Ni, V
IIb	Qz-Ep-Ch	Mg, Na, Al, Fe ²⁺ , H, Zn, V	Ca, Fe ³⁺ , CO ₂ , K, Ba, Sr, As, Rb
IIIb	Ab-Ch-Ms-Py	Mg, Na, Al, Fe ²⁺ , H, As, Zn, V, Sb	Ca, Fe ³⁺ , CO ₂ , TOC, K, Ba, Sr, Rb, As, Sb
IVb	An-II-Py	Mg, Fe ^T , S, Zn, V	Si, Ca, Fe ³⁺ , CO ₂ , K, Ba, Sr
Vb	Ca-II-Py	Ca, CO ₂ , Mn, Fe ^T , S, K, P, Ba, Be, Sr, Sb, As, Se	Na, H, Ni
VIb	Sa-Ta-Py	Mg, Si, Fe ²⁺ , H, Mn, V	K, Fe ³⁺ , Ba, Sr, Zn, Rb, Cu
<i>Reaction zone (Site 857)</i>			
Ic	Qz-Wa-Ep	Si, Ca, Al, Fe ³⁺ , Sr	Fe ²⁺ , Mg, Na, K, H, CO _{2T} , Ba, Be, Cu, Zn, As, Se, Rb, Ni, Cr, Co
IIIc	Ab-Py	Na, Fe ²⁺ , Ba, S, Zn, Se	Fe ³⁺ , Ca, CO ₂ , Sr

Note: Qz = quartz; Ch = chlorite; Ms = muscovite; Ru = rutile; Ep = epidote; Wa = waikite; Ab = albite; Sm = smectite; Sa = saponite; Il = illite; Ta = talc; Fp = feldspar; Ba = barite; An = anhydrite; Ca = clacite; Py = pyrite; Po = pyrrhotite; Cp = chalcopyrite; Sp = sphalerite.

has caused massive precipitation of Mg from heated seawater that was locally entrained into the hydrothermal cell. The Mg-bearing minerals include Mg-rich smectite, mixed-layer smectite-chlorite, and chlorite. At temperatures of 150°C and higher, Mg is almost completely removed from heated seawater during reaction with basalt (Mottl and Holland, 1978; Seyfried and Mottl, 1982).

The marked increase of reduced S in most of the alteration zones at Middle Valley suggests that Fe-bearing minerals such as magnetite and amphibole were sulfidized by hydrothermal H₂S that migrated outward from the fluid discharge conduit. The hydrothermal dissolution of biogenic and diagenetic carbonates in Zone IIb by hydrothermal fluids is reflected by a major decrease in CaO and CO₂. The alteration zones surrounding Zone IIa consist of anhydrite-illite-pyrite (Zone IIIa) and carbonate-illite-pyrite (Zone IVa). Zone IIIa is characterized by low contents of biogenic carbonate and high abundances of hydrothermal Mg-rich clays and illite as illustrated on a CaO - (MgO + Na₂O)/2 - K₂O ternary diagram (Fig. 24). This zone is also enriched barite and pyrite as reflected by elevated contents of Ba,

S, Cu, Zn, Sb, and As. Zone IVa, the outermost zone, is characterized by hydrothermal calcite, illite, and pyrite, and is enriched in Ca, CO₂, MgO, S, Fe²⁺, Mn, Sr, and Zn (Table 5).

The retrograde solubility of anhydrite (Blount and Dickson, 1969) and the low SO₄ contents in end-member, high-temperature seafloor hydrothermal fluids (e.g., Edmond and Von Damm, 1985; Von Damm et al., 1985; Lydon et al., 1992; Butterfield et al., this volume) indicate that Zone IIIa probably formed by reaction between heated seawater and sediment at temperatures >150°C. The high S, Cu, Mo, As, and Sb abundances in this zone indicate that hydrothermal fluids flowed outward from the center of fluid upflow. Elevated metal contents in Zone IVa also indicate a hydrothermal metal contribution to this alteration zone.

AAV (Site 858)

The AAV and BH fluid upflow zones are morphologically and textually similar. The inner core (Zone Ib in the AAV) is characterized

Figure 18A. Downhole profiles of major element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 856A.

Figure 18B. Downhole profiles of minor and trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 856A.

Figure 18C. Downhole profiles of trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 856A.

by highly lithified, fractured, and brecciated hemipelagic and turbiditic sediment. Many of the fractures are filled to varying degrees with hydrothermal quartz, wairakite, epidote, and sulfides. These minerals have also been precipitated in the interstices between detrital grains in turbiditic sandstone and siltstone. Zone Ib, which occurs at two depth intervals within Hole 858F, may be a stratabound zone that formed by the lateral flow of hydrothermal fluids from a vertical or near-vertical fluid-discharge conduit. The proximity of Hole 858F to active vents (Fig. 4) is consistent with this interpretation (Goodfellow and Franklin, 1993).

The sediments surrounding Zones Ib and IIb are also highly indurated and are locally fractured and veined (Zone IIIb). Zone IVb, which surrounds Zone IIIb, is characterized by moderately indurated sediments that contain anhydrite, clays, and pyrite that both replace hemipelagic sediment and infill the interstices between detrital grains (Leybourne and Goodfellow, this volume). The outer margin of Zone IVb marks the boundary between soft and indurated sediment, and has high contents of carbonate cement and concretions (Zone Vb). The base of Zone Vb in Hole 858C consists of carbonate hydrothermal breccia composed of breccia clasts and calcite-cemented hemipelagic sediment (Fig. 12). Zone VIb was only intersected in Hole 858B, which was collared within several meters of an active vent (Fig. 4). The sediment below 24 mbsf (Zone VIb) is moderately indurated, brecciated, and pervasively replaced by hydrothermal Mg-rich silicates.

The alteration assemblages in the core of the AAV upflow zone are distinct from those in the core of the BH discharge conduit. Unlike Zone Ia-1 at BH, Zone Ib, which is within the center of hydrothermal fluid upflow, is characterized by wairakite, epidote, and quartz. Hydrothermal calcic plagioclase has also been observed in one thin section (Leybourne and Goodfellow, this volume). Except for detrital quartz that is commonly overgrown by hydrothermal quartz, all sedimentary minerals are replaced by wairakite and epidote. The intergrowth of wairakite, epidote, and quartz in veins indicate that these minerals were coprecipitated. The Ca-rich nature of this hydrothermal assemblage is reflected by bulk compositions that plot near the CaO apex along the CaO - (MgO + Na₂O)/2 axis on a (MgO + Na₂O) - K₂O - CaO ternary plot (Fig. 25). The composition of samples from Zone Ib is distinctly different from the core of the BH upflow zone (Zone Ia-1), which is less calcic and plots along the (MgO + Na₂O)/2 - K₂O axis (Fig. 24).

The Mg-poor nature of Zone Ib indicates that hydrothermal minerals were precipitated from end-member, hydrothermal fluid essentially devoid of Mg and similar to vent fluids at AAV (Lydon et al., 1992; Butterfield et al., this volume). Fluid inclusion temperatures for quartz from Zone Ib at the AAV (270° to 288°C; Peter et al., this volume) are similar to measured temperatures (184° to 276°C) for hydrothermal vent fluids at this site (Goodfellow and Franklin, 1993). Furthermore, the occurrence of Zone Ib vertically below an active vent field and the similarity of ⁸⁷Sr/⁸⁶Sr ratios in Zone Ib (0.704853; W.D. Goodfellow, unpubl. data) and AAV average vent fluids (0.70424; Butterfield et al., this volume) also suggest that the quartz-wairakite-epidote assemblage formed from hydrothermal fluids similar to those now venting at the AAV.

The composition of end-member hydrothermal fluids from AAV was plotted on a logarithmic activity phase diagram for the system CaO-Al₂O₃-SiO₂-H₂O at 275°C and 500 bars using the computer program PTAX (Brown et al., 1988A, B) and the internally consistent thermodynamic database of Berman (1988) (Fig. 26). The coexistence of epidote and wairakite with quartz in Zone Ib indicates that fluids in equilibrium with this mineral assemblage should be restricted to a narrow range of log $a_{Ca^{2+}/a_{2H^{+}}}$ and log a_{SiO_2} (aqueous). However, measured log a_{SiO_2} (aqueous) values (Lydon et al., 1992; Butterfield et al., this volume) are considerably greater than equilibrium values and indicate that the fluids venting at AAV are supersaturated with respect to quartz. Silica supersaturation is common in vent fluids (e.g., Von Damm et al., 1985) because of the sluggish kinetics of quartz precipitation (Bowers et al., 1985; Seyfried et al., 1991). The log $a_{Ca^{2+}/a_{2H^{+}}}$

Table 6. Relative gains and losses ($\log W_B/W_A$) of elements in representative samples from hydrothermal alteration zones associated with the BH and AAV fluid upflow conduits, and the reaction zones below 450 mbsf at Site 857.

Location	Sample number	Zone	Fv(TiO ₂)	Fv(Yb)	Density	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO	MgO	CaO	Na ₂ Oc	K ₂ O	P ₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC
Site 856 (Bent Hill)	856A-8H-01, 8–10 cm	IVa	1.21	0.94	2.78	-0.03	-0.06	-0.53	-0.07	-0.57	0.05	0.54	0.20	0.45	-0.06	-0.22	0.24	0.06	0.44	0.61	0.94	-0.14
	856B-6H-6, 118–122 cm	IIIa	1.00	1.16	2.77	0.02	0.03	0.06	0.10	-0.49	0.23	0.04	0.30	-1.00	-0.30	0.22	0.04	0.24	0.74	-0.11	-2.81	0.04
	856B-13X-4, 128–132 cm	IIa	1.03	1.17	2.92	0.08	0.03	0.06	0.00	ND	ND	0.90	0.34	-0.96	0.13	-0.32	0.05	0.20	0.74	-0.46	-2.78	-0.41
	856B-15X-6, 6–8 cm	Ia-2	1.08	1.03	2.80	0.01	-0.10	-0.02	0.01	-0.19	0.07	-0.32	0.48	-6.54	-1.22	-1.26	0.09	0.39	0.76	-0.60	-1.21	-0.45
	856B-15X-1, 91–93 cm	Ia-1	1.24	1.75	0.18	0.18	0.08	0.19	0.48	ND	ND	0.61	0.25	-1.13	-1.39	0.17	-0.08	-3.32	1.10	-0.35	-2.66	-0.29
Site 858 (AAV)	858B-5H-01, 140–143 cm	VIb	1.50	2.27	2.67	0.10	0.09	0.04	0.02	-0.90	0.07	0.60	1.14	-0.03	-0.11	-0.95	-0.20	0.76	-0.28	0.03	ND	ND
	858C-3H-1, 78–81 cm	Vb	4.77	4.04	2.70	0.04	-0.04	0.04	0.15	ND	ND	1.23	0.03	1.68	-0.19	0.15	0.75	-5.87	1.63	1.92	2.30	0.16
	858A-18X-3, 14–16 cm	IVb	0.98	0.87	2.86	-0.06	-0.03	0.02	0.08	-0.54	0.21	0.18	0.31	-0.51	-0.11	-0.07	0.01	0.24	0.29	-0.19	-2.86	-0.19
	858A-30X-1, 67–70 cm	IIIb	0.90	1.15	2.79	-0.01	0.05	0.06	0.05	-0.98	0.21	0.21	0.26	-0.41	0.14	-0.16	0.08	0.18	0.29	-0.26	-2.83	-0.16
	858F-25R-1, 19–21 cm	Ib	0.95	1.26	2.70	0.01	0.06	0.08	0.06	-0.66	0.19	0.26	0.34	-0.33	0.18	-0.32	0.01	0.20	-0.24	-0.29	-2.81	-0.14
	858F-9R-1, 18–20 cm	Ib	1.75	1.35	2.70	0.27	-0.56	0.09	-0.39	-0.82	-0.27	-0.30	-0.40	0.43	-0.70	-1.36	-0.01	0.30	-0.75	-0.57	-2.66	-0.30
Site 857	857C-21R-3, 27–29 cm	IIIc	1.12	1.17	2.60	0.04	0.01	0.06	0.06	-0.12	0.11	0.04	0.01	-0.17	0.16	0.03	0.08	0.02	-0.08	-0.08	-0.81	0.04
	857D-17R-3, 23–25 cm	Ic	1.96	1.61	2.82	0.34	-0.04	0.13	0.07	0.43	-0.25	0.34	-0.05	0.62	-0.92	-1.28	0.00	0.01	-0.12	-0.97	ND	ND
Location	Sample number	Zone	Fv(TiO ₂)	Fv(Yb)	Ba	Be	Co	Cr	Cu	La	Nb	Ni	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb
Site 856 (Bent Hill)	856A-8H-1, 8–10 cm	IVa	1.21	0.94	-0.14	-0.04	-0.01	-0.10	-0.19	0.04	-0.35	-0.09	-0.20	-0.11	0.05	-0.10	0.10	0.06	0.07	-0.03	-0.45	0.00
	856B-6H-6, 118–122 cm	IIIa	1.00	1.16	0.07	0.07	0.12	0.02	0.07	0.01	0.19	0.07	0.24	0.06	-0.68	0.07	0.02	-0.03	0.25	-0.02	-0.30	0.24
	856B-13X-4, 128–132 cm	IIa	1.03	1.17	-0.14	0.03	0.07	-0.03	-0.23	-0.01	0.27	-0.06	-0.28	0.02	-0.72	0.04	0.00	-0.03	0.01	0.01	-0.61	-0.31
	856B-15X-6, 6–8 cm	Ia-2	1.08	1.03	-0.96	-0.27	-0.85	-1.26	1.12	-0.50	0.16	-1.03	-0.98	-0.05	-0.52	-0.83	-0.06	0.010	-1.47	-0.03	0.18	-0.35
	856B-15X-1, 91–93 cm	Ia-1	1.24	1.75	0.14	0.06	0.23	0.06	1.88	0.07	-0.20	0.01	-0.12	0.11	-1.32	0.058	0.09	-0.08	0.43	0.05	0.70	-0.20
Site 858 (AAV)	858B-5H-1, 140–143 cm	VIb	1.50	2.27	-0.59	-0.12	-0.12	0.07	-0.35	0.03	0.48	0.10	-0.46	0.00	-0.42	0.22	-0.05	-0.09	-0.17	0.16	-0.72	-0.12
	858C-3H-1, 78–81 cm	Vb	4.77	4.04	0.36	0.60	0.06	0.03	0.21	0.41	0.56	-0.13	0.15	0.00	0.21	0.16	0.34	0.04	-0.01	-0.08	0.82	1.28
	858A-18X-3, 14–16 cm	IVb	0.98	0.87	-0.27	0.02	-0.02	-0.13	0.02	-0.13	0.11	0.01	-0.07	0.03	-0.56	0.08	0.06	0.03	0.08	-0.15	0.11	-0.40
	858A-30X-1, 67–70 cm	IIIb	0.90	1.15	-0.37	0.02	0.10	-0.09	-0.15	-0.04	0.19	-0.07	-0.12	0.06	-0.41	0.08	-0.05	-0.05	0.10	-0.16	0.05	0.27
	858F-25R-1, 19–21 cm	Ib	0.95	1.26	-0.27	0.07	-0.10	-0.02	0.05	-0.05	0.16	-0.10	-0.36	0.10	-0.21	0.13	-0.01	-0.06	0.11	-0.06	0.32	-0.34
	858F-9R-1, 18–20 cm	Ib	1.75	1.35	-0.81	-0.20	-0.40	-0.06	-0.38	0.16	0.40	-0.33	-0.53	-0.10	-0.50	-0.15	-0.01	0.06	-0.44	0.18	-0.80	-0.20
Site 857	857C-21R-3, 27–29 cm	IIIc	1.12	1.17	0.05	0.07	0.04	-0.03	-0.02	0.04	0.07	-0.09	-0.01	0.01	-0.04	0.00	0.02	-0.01	0.09	-0.07	-0.20	0.22
	857D-17R-3, 23–25 cm	Ic	1.96	1.61	-0.73	-0.12	-0.32	-0.17	-0.34	0.03	0.26	-0.35	-0.45	-0.06	0.25	-0.10	0.04	0.04	-0.34	0.13	-0.32	-0.12

Note: ND = not determined; Fv = volume factor; density = grams/cm³.

Figure 19A. Downhole profiles of major element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 858A.

Figure 19B. Downhole profiles of minor and trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 858A.

ratio of AAV fluids plots near the wairakite-clinozoisite mineral stability boundary, indicating near-equilibrium conditions for these components. AAV hydrothermal fluids have end-member Ca^{2+} concentrations (≈ 80 mmol; Lydon et al., 1992; Butterfield et al., this volume) that are double those for hydrothermal fluids vented at sediment-bare ridges (e.g., Von Damm, 1990). The high Ca content of end-member AAV hydrothermal fluids accounts for the presence of abundant Ca-silicate minerals in Zone Ib. Possible sources of Ca include biogenic carbonate and calcic plagioclase in hemipelagic and turbiditic sediments and mafic sills, and possibly CaSO_4 deposited by downwelling hydrothermal fluids.

Calcium fixation is enhanced with increasing temperature provided the pressures are sufficiently low. Temperatures $>350^{\circ}\text{C}$ favor the removal of Ca from solution, H^+ production, heavy metal solubilization, and the formation of epidote and, in some cases, Ca-plagioclase (Seyfried et al., 1988). Epidote-rich rocks may represent a permeable reaction zone dominated by hot, ascending hydrothermal fluids. Na fixation, in contrast to Ca and Mg, is retrograde and may dominate reaction zones affected by ascending hydrothermal fluids that are cooled conductively.

Zone IIb of the AAV, which surrounds Zone Ib near the core of the upflow zone, is distinguished by a lack of wairakite and the presence of Mg-rich chlorite that replaces sedimentary feldspar, mica, and illite. The chloritization of K-silicates is reflected by the addition of Mg and the depletion of K, Rb, Ba, and Sr. Copper, Zn, As, Sb, and Se also are depleted in Zone IIb (Table 3) relative to unaltered hemipelagic and turbiditic sediment (Table 2). The occurrence of hydrothermal epidote and Mg-rich chlorite in Zone IIb near the core of the AAV discharge conduit suggests that this zone formed either by (1) the mixing of entrained seawater with hydrothermal fluids or (2) the partial overprinting of a high-temperature mineral assemblage (Zone Ib) by a retrograde assemblage precipitated from lower-temperature modified seawater. Zone IIIb consists of Mg-rich chlorite and albite formed by the replacement of feldspar, mica, and illite. These replacement reactions resulted in the addition of Mg and Na, and depletion of K, Rb, Ca, Sr, and Ba (Table 3). The addition of Mg in Zone IIIb indicates that it formed by the reaction of heated seawater with sediment enveloping the main hydrothermal-fluid conduit.

The sulfidation of Fe-bearing minerals pyrite and amphibole, and high S, As, Sb, and Se contents in Zones IVb and Vb (Table 3) indicate that hydrothermal fluids migrated to the outermost margins of the upflow zone and precipitated sulfides along with retrograde calcite and anhydrite at lower temperatures. Other evidence for the upward and outward migration of hydrothermal fluids includes (1) positive $\delta^{34}\text{S}$ values in euhedral pyrite from Zone Vb (0.8 to 10.6‰) that approach values for massive sulfides at AAV (11.7 to 13.5‰) but are distinct from isotopically light, diagenetic S (–12.4 to –39.7‰) (Goodfellow et al., 1993); and (2) $^{87}\text{Sr}/^{86}\text{Sr}$ initial ratios in calcite and barite from Zones IVb and Vb (0.7060–0.7065; Goodfellow et al., 1993) that are transitional between seawater (0.70918) and hydrothermal fluid Sr (0.7042) (Butterfield et al., this volume).

Within Zone IVb, fluid temperatures estimated from fluid inclusions in anhydrite are between 230° and 311°C (Peter et al., this volume). These temperatures are consistent with anhydrite's retrograde solubility and precipitation from seawater at temperatures generally >150°C. Anhydrite in veins probably formed by the rapid heating of seawater by hydrothermal fluids nearer the core of the upflow zone.

In Zone Vb temperatures of mineral precipitation calculated using equilibrium isotope fractionation factors between calcite and fluid, and assuming a $\delta^{18}\text{O}_{\text{SMOW}}$ values of 0.0‰ for the fluid, range between 20° and 180°C (W.D. Goodfellow, unpubl. data). These temperatures are in agreement with fluid inclusion temperatures in calcite concretions, which range between 112° and 192°C (Peter et al., this volume).

$\delta^{13}\text{C}$ values for fluids calculated from values for calcite for this zone range between -30.7 and -35.4% (Peter et al., this volume) and are much more negative than seawater. This suggests that the hy-

Figure 20A. Downhole profiles of major element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 858B.

Figure 20B. Downhole profiles of minor and trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 858B.

Figure 20C. Downhole profiles of trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 858B.

drothermal CH_4 has been oxidized by methanogenic bacteria (Goodfellow et al., 1993) and/or that biogenic carbonate dissolved from the inner alteration zone has been modified by mixing with carbonate dissolved in hydrothermal fluids. If calcite precipitated from a fluid of uniform carbon and oxygen isotope composition under equilibrium conditions, $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values of calcite would correlate positively, and variations would result only from variations in the temperature of precipitation. However, $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values for hydrothermal calcite in shallow cores that penetrated Zone Vb at the AAV show an inverse correlation on a plot of $\delta^{13}\text{C}$ vs. $\delta^{18}\text{O}$ (Goodfellow et al., 1993) that is best explained by precipitation over a narrow temperature range ($\approx 100^\circ\text{C}$) from a fluid of varying $\delta^{13}\text{C}$ (-15 to -30‰) and $\delta^{18}\text{O}$ ($+4$ to $+15\text{‰}$) composition under equilibrium conditions. The positive correlation of $\delta^{13}\text{C}$ with temperature shows that the contribution of isotopically light carbon increases away from hydrothermal vents. $\delta^{13}\text{C}$ values calculated for fluids using $\delta^{13}\text{C}$ values of calcite in carbonate concretions assuming equilibrium fractionation and using oxygen isotope geothermometry (assuming $\delta^{18}\text{O}$ fluid = 0.0‰) vary between -19.95‰ at 234°C and -31.62‰ at 137°C (Peter et al., this volume). Such values are consistent with in-situ oxidation of CH_4 by methanogenic bacteria at temperatures $<137^\circ\text{C}$ near the outer margins of the fluid upflow zone (Goodfellow et al., 1993).

At shallow depths near active vents, alteration minerals in hemipelagic and turbiditic sediment are distinct from those described above for Zone Vb. Near active vents at the AAV, alteration consists mainly of saponite in shallow (<10 m) sediment cores (Goodfellow et al., 1993; Turner et al., 1993). The only hole with similar alteration drilled during Leg 139 was Hole 858B (38-m depth), located within a few meters of an active vent at the AAV (Fig. 4). Stratabound sulfide-anhydrite occurs at 11 mbsf within hemipelagic and turbiditic sediments that are crosscut by anhydrite veins to a depth of about 24 mbsf. Between 24 and 38 mbsf, the hemipelagic and turbiditic sediment is fractured, brecciated, and intensely altered to a Mg-rich clay (Zone VIb). High MgO contents (up to 30 wt%) indicate that Zone VIb formed by the reaction of locally recharged seawater with sediment adjacent to the hydrothermal fluid conduit. A $^{87}\text{Sr}/^{86}\text{Sr}$ value of 0.704204 (Sample 139-858B-5H-4, 27–29 cm; W.D. Goodfellow, unpubl. data) indicates that most of the Sr was derived from hydrothermal fluids (average $^{87}\text{Sr}/^{86}\text{Sr}$ = 0.70424; Butterfield et al., this volume). The minimum water/rock ratio is 133 based on a Mg content of 52.8 mmol/kg for Middle Valley seawater (Butterfield et al., this volume) and a mass gain of MgO in Zone VIb of 28.2 wt% (Table 4). Manganese, Mo, and S are enriched in Zone VIb, whereas most of the alkali elements have been depleted by the replacement of feldspar, mica, and illite by Mg-rich clay.

Temperatures in hydrothermal reaction zones calculated using mineral chemistry thermometry are generally greater than temperatures measured at the seafloor at many vent sites on the modern seafloor (Ding and Seyfried, 1989), suggesting that the fluids have cooled during transit to the seafloor. Von Damm et al. (1985) concluded that the fluids had conductively cooled at the National Geographic Society vent at 21°N , East Pacific Rise (EPR), whereas Bowers et al. (1988) and Campbell et al. (1988) proposed that cooling of the reaction zone in the vicinity of the magma chamber accounted for the decreased temperature of vent fluids. In the case of Middle Valley, the low sulfide content of active vent fluids and their products from the AAV and south of BH, and the upflow zone at Site 558 (Zone Ib) compared with the BH upflow zone (Zone Ia-1) and its related massive sulfide deposit, suggest that the composition of the hydrothermal fluids has evolved from high-temperature, metal-rich fluids to moderate-temperature ($<300^\circ\text{C}$), metal-poor fluids. In the AAV, the low-metal hydrothermal system has probably been active for at least 2000 years based on the content of detrital TiO_2 in 80 cm of hydrothermal sediment overlying hemipelagic sediment in core TUL87B-15 and assuming an ambient sedimentation rate of 11 cm k.y.^{-1} as determined by ^{14}C dating of Holocene foraminifers in hemipelagic sediment (Goodfellow and Franklin, 1993). The similarities between the AAV and BH hydrothermal fluid

Figure 21A. Downhole profiles of major element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 858C.

Figure 21B. Downhole profiles of minor and trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 858C.

Figure 21C. Downhole profiles of trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Hole 858C.

compositions (Butterfield et al., this volume) indicate a common source and origin, and on this basis a transition from high-temperature, metal-rich fluids to lower-temperature, metal-poor fluids at BH also occurred more than 2000 years ago.

Hydrothermal Reaction Zone

Hydrothermally altered sediments at Site 857 are zoned upward from a quartz-epidote $\pm$ wairakite $\pm$ chlorite assemblage (Zones Ic and IIc below 450 mbsf) to albite - chlorite - pyrite (Zone IIIc) and calcite - illite - pyrite (Zone IVc). This zonation corresponds to a fairly uniform increase of temperature downhole, reaching a maximum of 300°C at about 450 mbsf (Baker et al., this volume; W.D. Goodfellow, unpubl. data). Between 450 and 695 mbsf in Hole 857D, fluid inclusion temperatures for wairakite range between 242° and 350°C and do not show any systematic downhole variation (Peter et al., this volume). This, combined with the stratabound nature of Zone Ic and its pervasive alteration, suggests that this reaction zone behaved essentially isothermally during most of its history and is therefore a reservoir for hydrothermal fluids that are presently venting at the AAV. This interpretation is consistent with the conclusion that temperature conditions in the sediment-sill complex below about 470 mbsf are isothermal, based on downhole temperature measurements and physical properties (Davis and Wang, this volume). The extensive reaction between hydrothermal fluid and sediments is shown by $\delta^{18}\text{O}_{\text{SMOW}}$ values as low as 5.48‰ for altered sediment from Zone Ic (compared to values between 10.9 and 11.7‰ for bulk sediments; Goodfellow et al., 1993), a primitive $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.704307 in Zone Ic (W.D. Goodfellow, unpubl. data), and replacement of all sedimentary silicates with the exception of detrital quartz by quartz and epidote. The replacement of K-Al-silicates by Ca-Al-silicates and albite is reflected by a marked decrease in elements that occur in K-feldspar and mica (K_2O , Rb, and Ba), and an increase in CaO, Na_2O , and Sr contents (Fig. 23). Samples from Zone Ic (Fig. 27) overlap the compositional field for samples from the AAV upflow zone (Zone Ib) (Fig. 25). The alteration of sedimentary minerals in this zone is recorded by major decreases of Zn, Cu, Be, As, Sb, and Se relative to unaltered sediment (Table 3). Lead is also probably leached from this zone although the extent of Pb loss cannot be determined because of the high detection limits (20 ppm) of the analytical methods used.

The upward zonation of hydrothermal minerals at Site 857 is similar to the distribution of minerals about the Site 858 upflow zone, suggesting that the processes of hydrothermal alteration are similar in both areas. In the case of the AAV (Site 858), hydrothermal fluids have clearly migrated outward, mixed with connate fluids and entrained seawater, and reacted with hemipelagic and turbiditic sediments under decreasing temperature conditions. At Site 857, hydrothermal fluids have also migrated upward from the reaction zone and reacted with sediments, producing the mineral zonation observed in Holes 857C and 857D. The addition of elements (e.g., Na, Fe, Mg) in Zone IIIc and $^{87}\text{Sr}/^{86}\text{Sr}$ ratios that increase upward from 0.704307 in Zone Ic to 0.70650 in Zone IIIc (W.D. Goodfellow, unpubl. data) indicates major upward advection of fluids from the hydrothermal reservoir (Zones Ic and IIc).

Several indicators suggest that hydrothermal fluids venting at AAV originate from a hydrothermal reaction zone similar to that at Site 857: (1) the mineral assemblages (Leybourne and Goodfellow, this volume) and bulk chemistry of the reaction Zone Ic at Site 857 and Zone Ib near the center of fluid upflow at the AAV are similar and therefore have formed from fluids of similar composition; (2) the Sr isotope composition of altered sediments from Zone Ic ($^{87}\text{Sr}/^{86}\text{Sr} = 0.704307$, Sample 857D-11R-1, 1–3 cm; W.D. Goodfellow, unpubl. data) is nearly identical to an average $^{87}\text{Sr}/^{86}\text{Sr}$ value of 0.70424 in vent fluids from the AAV (Butterfield et al., this volume); (3) high trapping temperatures measured for fluid inclusions in quartz and wairakite from Zones Ib (AAV) and Ic (Site 857) fall within the same

Figure 22A. Downhole profiles of major element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Holes 858D and 858F.

Figure 22B. Downhole profiles of minor and trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Holes 858D and 858F.

Figure 22C. Downhole profiles of trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Holes 858D and 858F.

range (242° to 350°C; Peter et al., this volume) as do temperatures for vent fluids (184° to 274°C; Goodfellow and Franklin, 1993); and (4) the similarity of Na, Ca, and Cl contents of inclusion (Peter et al., this volume) and AAV vent fluids (Lydon et al., 1991; Butterfield et al., this volume) at AAV. Therefore, the wairakite-epidote-quartz assemblage in both the upflow (Zone Ib) at AAV and underlying reaction (Zone Ic; Site 857) zones equilibrated with hydrothermal fluids similar to those at AAV. Log $a\text{Ca}^{2+}/a2\text{H}^{+}$ ratios for vent fluids from AAV straddle the wairakite-clinozoisite stability boundary but are displaced to higher silica activities because of its supersaturation with respect to quartz (Fig. 26). The dominance of Ca-bearing phases in Zone Ic (Site 857) is consistent with the high $a\text{Ca}^{2+}/a\text{Na}^{+}$ ratios in vent fluids from the AAV (Lydon et al., 1992; Butterfield et al., this volume). Possible sources of Ca include (1) biogenic carbonate, (2) calcic plagioclase dissolved and albitized, respectively, by downwelling seawater; and (3) anhydrite that may have been deposited in sediments below 450 mbsf during an earlier stage in the hydrothermal system and has now been dissolved.

The former presence of anhydrite in sediments that have reacted with 300°C fluids may have generated the highly positive S isotope values (mean = 8.1‰) for the high-temperature pyrrhotite-wurtzite-isocubanite in the BH massive sulfide deposit, which requires a major component of seawater sulfate (Goodfellow and Franklin, 1993). Although inorganic reduction of sulfate by reaction of hydrothermal fluids with seawater in sulfide chimneys and mounds may have occurred, the reduction potential is not sufficient to generate $\delta^{34\text{S}}(\text{H}_2\text{S})$ values above about 4.5‰ (Janecky and Shanks et al., 1988). The reaction of hydrothermal fluids with seawater sulfate from subsurface mixing or previously deposited anhydrite can, however, produce $\delta^{34\text{S}}(\text{H}_2\text{S})$ values that exceed 5‰.

Most of the elements leached from Zone Ic at Site 857 are concentrated in hydrothermal anhydrite-sulfide chimneys, sedimentary sulfides, and alteration zones at the AAV (Goodfellow et al., 1993). For example, sulfidic sediments in shallow cores from the AAV contain up to 2.5 wt% Cu, 0.96 wt% Zn, 0.38 wt% Pb, 1.9 wt% Ba, 26 ppm As, 272 ppm Se, 14 ppm Sb, and 2.1 ppm Be (Turner et al., 1993). These elements are also concentrated in the sulfide unit in Hole 858B (Fig. 20) and in the outer alteration zones at Site 858 (Zones IIb to Vb). The similarity of the suite of elements which exhibits mass losses from Zone Ic (Site 857) and those concentrated in seafloor hydrothermal products at the AAV suggests that most of the metals, Ba, and Sr were leached from highly altered sediments intercalated with mafic sills below about 450 mbsf at Site 857. If the reaction zone underlying Middle Valley is at least 0.5 km thick, 10 km wide and 40 km long, the total mass loss from this zone, calculated on the basis of elements removed from Zone Ic, is 20 million tons of Zn, 8 million tons of Cu, and 220 million tons of Ba. Since the sulfide mass present at the AAV is far less than this amount of metals, estimates of the size of the reaction zone are either too large or most of the metals have been lost to the water column as occurs at 21°N, EPR (Converse et al., 1984).

SUMMARY AND CONCLUSIONS

- Two distinct hydrothermal upflow zones were penetrated during drilling in Middle Valley: BH (Site 856) and the AAV (Site 858). The general distribution of the hydrothermal fluid upflow and reaction zones, associated hydrothermal alteration, seafloor depositional products, and the fluid flow regime are shown on a schematic block diagram of the Middle Valley sedimented rift in Figure 28.

- The BH upflow zone is a fossil hydrothermal fluid discharge conduit associated with a major sulfide deposit near the southern flanks of a sediment mound. This upflow zone is texturally, mineralogically, and chemically zoned from a highly indurated, fractured, and veined inner core consisting of quartz + muscovite + chlorite + rutile + sulfides to weakly altered sediments on the margins of the fluid conduit. The inner core is characterized by mass gains of Si, Fe,

Figure 23A. Downhole profiles of major element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Holes 857A, 857C and 857D.

Figure 23B. Downhole profiles of minor and trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Holes 857A, 857C and 857D.

Figure 23C. Downhole profiles of trace element bulk compositions for altered and unaltered hemipelagic and turbiditic sediments, Holes 857A, 857C and 857D.

Al, Mg, S, K, Mn, Cu, Ba, Zn, Se, Co, and Cr, and mass losses of Ca, Na, CO₂, TOC, As, and Sc. In the surrounding alteration zones, Mg and Fe have been added at the expense of alkali elements bound in detrital feldspar and micas. Pyrrhotite-chalcocopyrite veins associated with quartz that precipitated at temperatures up to 338°C in the core of this upflow zone indicate that the BH sulfide deposit formed from a high-temperature metalliferous fluid.

3. The AAV upflow zone is associated with anhydrite-sulfide chimneys that are actively discharging 184° to 276°C fluids (Goodfellow and Franklin, 1993). This fluid conduit is zoned from a lithified, fractured, brecciated, veined, and high-temperature (250°–316°C) inner core composed of quartz-wairakite-epidote to weakly altered sediments on the margins of the upflow zone. The major elements added to the core of the conduit are Ca, Si, Al, and H; elements removed include Fe, Na, K, CO₂, TOC, Ba, Sr, Rb, Zn, As, Cu, Ni, and V.

4. Although the BH and AAV upflow zones are similar in size and morphology, the inner cores are mineralogically and geochemically distinct and have formed by reaction with hydrothermal fluids of different temperature and composition. The venting of metal-poor, moderate temperature ($<300^{\circ}\text{C}$) fluids at the AAV and 330 m south of BH (Goodfellow and Franklin, 1993), and fluid inclusion temperatures of $200^{\circ}\text{--}300^{\circ}\text{C}$ quartz interstitial to massive sulfides (Peter et al., this volume), indicate that the temperature, metal-content, and possibly source of hydrothermal fluids in Middle Valley have changed with time.

5. The textural, mineralogical, and chemical zonation about the AAV and BH upflow zones is consistent with precipitation from upflowing and outflowing hydrothermal fluid that mixed with down-drawn, heated seawater on the margins of the discharge conduit. The inner core assemblages are products of reaction between sediments and end-member hydrothermal fluid, whereas the surrounding alteration zones formed by the reaction of sediments with chemically evolved hydrothermal fluids and heated entrained seawater.

6. The local hydrology within zones of fluid upflow is probably complex due to the low cross-stratal permeability of unaltered sediments, the highly variable permeabilities from the core to the margins of the conduit, and temporal variability in permeability due to the filling of fractures by hydrothermal minerals. During periods of unrestricted fluid discharge in the central conduit, seawater was probably entrained into the discharge conduit, resulting in the dumping of Mg in the form of Mg-rich silicates. Clogging of the conduit by mineral precipitation may have forced fluids laterally along permeable turbidites, producing the widespread alteration that surrounds the inner core. Because such sealing and breaching of the upflow zone most likely occurred episodically, the direction of lateral flow probably alternated from outward-flowing to inward-flowing fluids. This change in hydrologic regime may account for the overprinting of Mg-rich minerals by high-temperature phases, and the formation of lower-temperature minerals in fractures (e.g., anhydrite, calcite) that crosscut the high-temperature, lithified core.

7. The mineralogical similarities between hydrothermally altered sediment in the core of the AAV upflow zone and the Site 857 sediment-sill complex indicate that vent fluids at AAV probably originated in a hydrothermal reaction zone at the base of the Middle Valley sedimentary sequence. This conclusion is supported by Sr and Pb isotope results (Goodfellow and Franklin, 1993) that clearly indicate mixed sedimentary and basaltic sources for hydrothermal carbonates and sulfides.

8. The Middle Valley hydrothermal system is complex and has evolved with time; it consisted of (1) a reaction zone, probably associated with a high-level magma body near the rift axis, where high-temperature, metal-rich "black smoker"-type fluids were generated, and (2) a secondary reaction zone in the sill complex near the base of the sedimentary pile where these fluids acquired isotopically heavy S by reaction with sediments (possibly containing anhydrite). It was this modified high-temperature system that generated the large, hydrothermally inactive BH massive sulfide deposit at Site 856. The

Figure 24. Ternary ($\text{MgO} + \text{Na}_2\text{O}$) - K_2O - CaO plot showing the chemical changes between the alteration zones at BH (Site 856). Zone Ia = quartz + (Fe)chlorite + muscovite + rutile + sulfides; IIa = quartz + chlorite + pyrite; IIIa = anhydrite + clay + pyrite + barite; IVa = calcite + clay + pyrite.

Figure 25. Ternary ($\text{MgO} + \text{Na}_2\text{O}$) - K_2O - CaO plot showing the chemical changes between alteration zones at the AAV (Site 858). Zone Ib = wairakite + epidote + quartz; IIb = quartz + chlorite + epidote + pyrite; IIIb = albite + chlorite + pyrite; IVb = anhydrite + illite + pyrite; Vb = calcite + clay + pyrite $\pm$ barite; VIb = saponite + pyrite.

present hydrothermal system at the AAV and south of BH is lower temperature and appears to be contained within the sediment-sill complex below about 450 mbsf. Hydrothermal fluids from this active system are generally $<300^\circ\text{C}$ and metal-poor. Hydrothermal precipitates consist of anhydrite-sulfide chimneys with higher Cu/Zn ratios than in the hydrothermally inactive BH sulfide deposit (Goodfellow and Franklin, 1993).

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Figure 26. $\log a\text{SiO}_2$ vs. $\log a\text{Ca}^{2+}/a^{2\text{H}^+}$ phase diagram for the system $\text{CaO} - \text{Al}_2\text{O}_3 - \text{SiO}_2 - \text{H}_2\text{O}$ at 275°C . End-member hydrothermal fluids from AAV have $\log a\text{Ca}^{2+}/a^{2\text{H}^+}$ ratios (Butterfield et al., this volume) that straddle the wairakite-clinzoisite equal activity boundary but are displaced to the right due to high $a\text{SiO}_2$ (aqueous) values. The supersaturation of silica reflects the sluggish kinetics of quartz crystallization.

Figure 27. Ternary ($\text{MgO} + \text{Na}_2\text{O}$) - K_2O - CaO plot showing the chemical changes between alteration zones and unaltered hemipelagic and turbiditic sediment at Site 857. Zone Ic = wairakite + epidote + quartz; Zone IIIc = albite + chlorite + pyrite.

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Figure 28. Schematic block diagram of the Middle Valley hydrothermal system showing the inactive hydrothermal fluid upflow zone, related alteration, and associated massive sulfide deposit at BH (Site 856), the active hydrothermal fluid upflow zone and associated alteration at the AAV (Site 858), and hydrothermal reaction zone below 450 mbsf at Site 857. Also shown is an inferred high-temperature reaction zone associated with a magma body at depth, and fluid flow directions (modified from Goodfellow and Franklin, 1993).

Table 1. Major and minor element analyses of sediment and sulfide samples performed at the Geological Survey of Canada and by ODP (Davis, Mottl, Fisher, et al., 1992).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Lithology	Induration	Moisture	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO	M
									wt%								
139	855A	01R	2	77	79	2.27	SLCY	non	35.9	53.20	0.86	15.30	9.10	5.30	3.40	0.12	3
139	855A	01R	4	70	74	5.20	SLCY	non	36.7	54.20	0.81	15.70	8.10	3.20	4.40	0.12	3
139	855A	01R	4	111	114	5.61	SLCY	non	ND	56.13	0.85	16.43	8.11	ND	ND	0.14	3
139	855A	02R	1	71	73	8.31	SLCY	non	ND	53.90	0.82	16.20	7.70	3.60	3.70	0.21	3
139	855A	02R	3	42	44	11.02	SAND	non	ND	61.24	0.78	15.80	5.92	ND	ND	0.10	2
139	855A	02R	3	69	71	11.29	SLCY	non	ND	54.60	0.81	17.70	7.70	3.00	4.20	0.12	3
139	855A	03R	2	80	82	18.90	SLCY	non	ND	56.86	0.91	17.08	8.58	ND	ND	0.12	4
139	855A	04R	1	112	115	27.12	SLCY	non	ND	52.00	0.78	16.20	8.70	3.50	4.70	0.14	4
139	855A	04R	3	96	98	29.96	SLCY	non	ND	50.50	0.74	14.30	7.40	2.70	4.20	0.18	3
139	855A	04R	4	81	83	31.31	SLCY	non	23.2	55.50	0.87	16.30	7.40	1.80	5.00	0.12	4
139	855A	05R	1	4	6	35.54	SLCY	non	34.2	54.90	0.87	16.30	7.90	2.70	4.70	0.13	4
139	855A	06R	1	100	104	46.50	SLCY	non	34.1	59.20	0.82	15.50	7.00	2.40	4.10	0.12	3
139	855A	07R	3	65	67	58.75	SNSL	non	52.0	55.90	0.63	12.60	8.00	3.60	4.00	0.13	3
139	855B	02R	1	106	110	6.76	SLCY	non	35.4	50.10	0.77	14.60	7.00	3.20	3.40	0.13	3
139	855B	04R	1	128	132	25.78	SLCY	non	33.3	57.50	0.78	15.80	7.10	2.30	4.30	0.13	3
139	855B	04R	3	122	126	28.72	SLCY	non	25.6	57.30	0.81	15.90	7.10	2.40	4.20	0.10	3
139	855B	04R	4	57	61	29.57	SNCL	non	22.5	64.30	0.71	14.40	5.20	1.20	3.60	0.08	2
139	855B	04R	4	99	102	29.99	SILT	non	ND	62.23	0.83	15.24	6.38	ND	ND	0.11	3
139	855B	04R	5	118	122	31.68	SLCY	non	42.1	50.60	0.72	14.60	6.70	2.60	3.70	0.20	3
139	855B	05R	1	25	28	34.25	SAND	non	ND	63.00	0.82	15.04	5.99	ND	ND	0.10	2
139	855C	01R	1	57	61	0.57	SLCY	non	40.4	51.90	0.78	14.90	7.00	3.20	3.40	0.10	3
139	855C	01R	3	55	57	3.55	SLCY	non	40.0	54.40	0.80	15.10	7.00	3.00	3.60	0.12	3
139	855C	01R	5	56	58	6.56	SLCY	non	38.9	55.30	0.77	15.50	7.20	3.10	3.70	0.12	3
139	855C	02R	1	53	57	9.23	SLCY	non	46.8	53.70	0.81	15.50	7.60	3.40	3.80	0.11	3
139	855C	02R	3	54	58	12.24	SLCY	non	41.1	54.00	0.79	17.00	7.80	3.20	4.10	0.13	3
139	855C	02R	5	52	56	15.22	SLCY	non	47.3	54.40	0.75	15.50	7.90	ND	ND	0.09	3
139	855C	03R	1	45	47	18.15	SLCY	weak	46.7	52.40	0.76	16.10	9.00	4.00	4.50	0.11	4
139	855C	04R	1	87	89	27.97	SLCY	weak	42.2	55.40	0.81	16.30	7.80	3.20	4.10	0.12	3
139	855C	04R	3	103	105	31.13	SLCY	weak	40.0	54.60	0.82	17.30	8.10	2.90	4.70	0.13	4
139	855C	06R	1	128	132	47.78	SLCY	weak	37.9	57.30	0.80	16.30	7.40	2.80	4.10	0.25	3
139	855C	06R	2	2	6	48.02	SLCY	weak	1.9	50.00	1.91	16.90	10.80	2.40	7.60	0.17	5
139	855C	06R	3	130	134	50.80	SLCY	non	37.8	57.00	0.86	15.80	7.40	2.60	4.30	0.17	3
139	855C	06R	5	76	80	53.26	SLCY	non	ND	59.03	0.89	16.59	7.64	ND	ND	0.13	3
139	855C	07R	1	76	80	56.86	SLCY	non	ND	54.03	0.90	16.00	11.87	ND	ND	0.13	4
139	855C	07R	2	83	87	58.43	SLCY	non	36.6	53.80	0.86	16.60	8.00	2.70	4.80	0.12	4
139	855C	07R	4	80	84	61.40	SLCY	non	30.0	56.90	0.79	15.30	6.60	2.00	4.10	0.12	3
139	855C	07R	6	60	64	64.20	SLCY	non	33.0	53.90	0.91	15.90	8.40	2.30	5.50	0.13	4
139	855C	08R	2	33	36	66.78	SILT	non	ND	59.82	0.93	16.72	7.27	ND	ND	0.13	3
139	855C	08R	2	40	44	66.85	SLCY	non	31.1	55.70	0.81	15.90	7.90	1.70	5.60	0.11	3
139	855C	10R	1	130	134	86.20	SLCY	weak	30.4	54.00	0.88	17.40	8.30	2.20	5.50	0.10	4
139	855C	10R	4	51	55	88.41	SLCY	weak	22.2	61.10	0.78	15.00	6.00	1.70	3.90	0.08	2
139	855C	10R	5	43	47	89.83	SLCY	non	ND	55.49	0.96	17.42	8.55	ND	ND	0.11	4
139	855C	11R	1	67	70	95.27	SAND	non	ND	64.04	0.82	14.76	5.78	ND	ND	0.09	2
139	855C	11R	1	115	119	95.75	SAND	non	19.4	63.00	0.83	14.30	6.20	1.60	4.10	0.09	2
139	856A	01H	1	69	72	0.69	SLCY	non	ND	51.04	0.78	15.04	7.23	ND	ND	0.12	3
139	856A	01H	1	95	98	0.95	SLCY	non	51.2	49.00	0.71	14.30	6.70	ND	ND	0.13	3
139	856A	02H	1	45	47	3.15	SLCY	non	41.4	55.40	0.80	16.40	7.70	ND	ND	0.12	3
139	856A	02H	2	62	64	4.82	SLCY	non	ND	56.23	0.83	16.18	8.12	ND	ND	0.10	3
139	856A	03H	1	107	111	13.27	SLCY	weak	30.0	59.00	0.78	15.40	6.50	1.90	4.10	0.08	3
139	856A	03H	2	67	71	14.37	SLCY	weak	ND	60.40	0.86	14.80	6.58	ND	ND	0.11	3
139	856A	03H	5	117	121	19.37	SLCY	weak	34.9	56.60	0.84	15.20	8.00	ND	ND	0.08	3
139	856A	03H	6	8	9	19.78	ND	weak	ND	31.90	0.44	8.56	4.38	ND	ND	2.06	2
139	856A	03H	7	12	16	21.32	SLCY	weak	30.6	58.10	0.85	15.50	6.80	2.40	4.00	0.09	3
139	856A	04H	2	37	41	23.57	SLCY	weak	24.5	61.40	0.79	15.10	5.90	1.60	3.90	0.09	2
139	856A	04H	2	86	90	24.06	SILT	weak	ND	58.36	0.87	16.48	7.10	ND	ND	0.10	3
139	856A	04H	4	36	40	26.56	SAND	weak	ND	62.90	0.80	14.40	5.50	1.70	3.40	0.09	2
139	856A	04H	6	55	59	29.75	SAND	moderate	17.7	62.50	0.93	13.50	5.50	1.90	3.20	0.09	2
139	856A	05H	2	73	77	32.31	SAND	moderate	20.5	64.60	0.69	13.50	4.60	1.40	2.90	0.07	2
139	856A	05H	3	73	77	33.81	SAND	moderate	ND	63.02	0.86	14.99	5.94	ND	ND	0.09	3
139	856A	05H	4	91	95	35.49	SLCY	moderate	30.9	54.40	0.85	15.60	7.70	0.80	6.20	0.10	4
139	856A	05H	5	29	31	36.37	SLCY	moderate	24.6	57.90	0.85	15.10	6.40	1.20	4.70	0.10	3
139	856A	05H	8	71	75	41.29	SAND	moderate	22.8	63.20	0.78	14.00	5.30	0.90	4.00	0.07	2
139	856A	06H	1	79	84	41.49	SNSL	moderate	19.8	63.40	0.80	13.90	5.20	1.40	3.40	0.07	2
139	856A	06H	2	88	92	43.08	SAND	moderate	ND	63.80	0.83	14.53	5.86	ND	ND	0.08	2
139	856A	06H	2	144	148	43.64	SLCY	moderate	33.0	52.20	0.79	15.50	7.80	1.70	5.50	0.11	4
139	856A	06H	3	103	107	44.73	SLCY	moderate	27.4	59.70	0.77	15.10	6.00	1.90	3.70	0.09	2
139	856A	06H	4	69	77	45.89	SAND	moderate	7.0	54.60	0.67	11.40	4.20	0.50	3.30	0.27	1
139	856A	06H	4	89	94	46.09	SNSL	moderate	18.0	64.40	0.80	13.80	5.30	1.20	3.70	0.06	2
139	856A	06H	5	104	106	47.74	SLCY	moderate	30.6	55.80	0.87	16.50	8.00	1.00	6.30	0.10	4
139	856A	06H	6	90	94	49.10	SNSL	moderate	15.7	64.30	0.74	13.30	5.40	1.00	4.00	0.06	2
139	856A	06H	7	61	65	50.31	SNSL	moderate	20.7	61.60	0.83	14.50	6.30	0.90	4.90	0.10	3
139	856A	07H	1	89	93	51.09	SLCY	moderate	31.8	53.20	0.82	16.00	7.90	0.80	6.40	0.09	4
139	856A	07H	2	95	99	52.65	SAND	moderate	ND	64.23	0.82	14.43	5.74	ND	ND	0.08	2
139	856A	07H	3	0	3	53.20	SILT	moderate	ND	61.80	0.77	15.20	5.90	1.00	4.40	0.08	3
139	856A	07H	3	81	85	54.01	SLCY	moderate	36.0	54.50	0.84	17.60	8.40	1.10	6.60	0.09	5
139	856A	07H	5	70	74	56.90	SLCY	moderate	30.1	56.30	0.84	16.80	8.00	0.90	6.40	0.10	5
139	856A	07H	6	139	142	59.09	SAND	moderate	ND	63.90	0.77	14.70	6.50	ND	ND	0.05	2
139	856A	07H	7	55	59	59.75	SLCY	moderate	28.6	58.10	0.86	16.40	7.50	0.90	5.90	0.08	4
139	856A	07H	0	24	28	60.20	SLCY	moderate	ND	17.80	0.34	6.50	4.70	0.40	3.90	0.91	10

Table 1 (continued).

CaO	Na ₂ O	Na ₂ OC	K ₂ O	P ₂₁₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC	Na ₂ OX	N	Total
wt%												
4.63	3.40	2.11	2.36	0.21	3.60	0.24	3.70	1.70	0.50	1.29	ND	99.80
4.61	3.90	2.46	2.11	0.20	3.10	0.27	2.70	1.20	0.40	1.44	ND	99.30
5.00	2.27	ND	2.22	0.20	5.04	0.14	3.11	1.32	0.49	ND	0.06	98.48
3.94	3.70	2.41	2.27	0.20	3.50	0.10	2.90	1.10	0.50	1.29	ND	99.20
4.32	1.79	ND	2.56	0.18	3.42	0.00	3.12	2.09	0.28	ND	0.06	98.51
3.35	3.20	2.22	2.91	0.18	3.20	0.12	2.50	1.00	0.40	0.98	ND	99.80
3.05	2.04	ND	2.21	0.20	5.31	0.18	ND	ND	0.46	ND	0.05	99.90
4.15	4.00	2.68	2.28	0.19	3.70	0.40	3.00	1.10	0.50	1.32	ND	99.30
7.44	3.50	2.48	1.96	0.21	4.20	0.41	5.30	3.60	0.50	1.02	ND	99.30
3.48	3.40	2.58	1.89	0.19	4.60	0.24	2.30	0.60	0.50	0.82	ND	99.90
3.67	4.00	2.73	1.99	0.18	4.20	0.19	1.60	0.10	0.40	1.27	ND	99.60
4.33	3.80	ND	1.68	0.19	3.10	0.15	1.40	0.50	0.20	ND	ND	100.50
4.64	3.60	2.49	1.98	0.13	4.70	0.54	4.50	2.00	0.70	1.11	ND	100.50
6.92	3.50	2.04	2.22	0.19	4.50	0.14	5.60	3.60	0.50	1.46	ND	99.20
3.73	3.80	2.86	1.88	0.19	3.80	0.16	2.00	0.50	0.40	0.94	ND	100.20
3.63	3.70	2.69	1.96	0.19	3.90	0.22	2.10	0.40	0.50	1.01	ND	100.10
4.42	3.80	ND	1.38	0.18	2.30	0.19	1.10	0.00	0.30	ND	ND	100.20
4.08	2.73	ND	1.69	0.22	3.51	0.32	1.80	0.66	0.31	ND	0.07	98.57
8.26	3.50	2.99	1.98	0.19	4.40	0.15	6.30	4.30	0.50	0.51	ND	100.90
4.66	3.04	ND	1.53	0.19	2.07	0.19	1.03	0.59	0.12	ND	0.04	98.29
5.70	3.80	2.18	2.45	0.19	3.60	0.20	5.30	0.00	0.00	1.62	ND	99.10
5.70	3.70	3.07	2.09	0.20	3.10	0.19	3.60	2.10	0.40	0.63	ND	99.10
5.09	4.00	2.99	2.04	0.19	2.50	0.15	2.70	1.30	0.40	1.01	ND	98.80
4.42	3.90	2.67	2.03	0.19	4.30	0.13	3.30	1.50	0.50	1.23	ND	99.60
3.31	3.40	2.13	2.77	0.19	4.60	0.13	2.80	1.00	0.50	1.27	ND	100.40
3.25	3.80	ND	2.40	0.17	5.60	0.24	3.50	0.00	0.00	ND	ND	101.40
4.61	3.70	3.23	2.26	0.18	4.10	0.36	3.80	1.70	0.60	0.47	ND	101.20
3.07	4.00	2.67	2.24	0.18	3.10	0.22	1.70	0.10	0.40	1.33	ND	98.60
3.72	3.90	2.66	2.18	0.20	4.70	0.19	2.00	0.40	0.40	1.24	ND	101.60
3.35	3.80	2.72	1.94	0.20	4.90	0.15	2.10	0.30	0.50	1.08	ND	101.70
11.90	3.00	ND	0.14	0.18	0.80	0.11	0.10	0.00	0.00	ND	ND	100.80
3.67	3.80	2.76	1.87	0.23	1.50	0.20	2.10	0.50	0.40	1.04	ND	97.80
3.80	2.42	ND	1.97	0.20	3.69	0.20	1.83	0.59	0.34	ND	0.06	98.52
2.81	2.07	ND	2.07	0.18	5.67	0.28	1.50	0.22	0.35	ND	0.08	96.87
3.47	3.60	ND	2.21	0.19	5.20	0.13	2.00	0.50	0.40	ND	ND	100.10
4.93	3.70	ND	1.76	0.23	4.00	0.36	2.40	0.90	0.40	ND	ND	100.00
4.24	3.80	ND	1.81	0.19	4.80	0.52	1.90	0.40	0.40	ND	ND	100.10
3.83	2.60	ND	1.91	0.20	4.32	0.22	1.58	0.37	0.33	ND	0.05	98.55
3.40	3.80	ND	1.92	0.19	4.60	0.94	1.10	0.00	0.30	ND	ND	99.50
3.10	3.20	2.43	2.47	0.21	4.00	0.20	2.50	0.70	0.50	0.77	ND	100.30
4.06	3.70	3.21	1.64	0.19	2.90	0.31	1.40	0.50	0.20	0.49	ND	99.70
3.34	2.19	ND	2.26	0.23	4.95	0.24	2.56	0.84	0.47	ND	0.07	99.19
4.70	3.16	ND	1.38	0.18	2.25	0.18	1.17	0.77	0.11	ND	0.03	98.63
4.89	4.00	3.61	1.35	0.17	1.90	0.25	1.00	0.50	0.10	0.39	ND	100.30
8.83	2.07	ND	2.19	0.17	5.40	0.15	7.46	4.97	0.68	ND	0.1	100.30
8.30	3.90	ND	2.12	0.18	4.60	0.16	6.40	0.00	0.00	ND	ND	100.20
3.51	3.80	ND	2.22	0.19	4.50	0.12	1.90	0.00	0.00	ND	ND	100.60
3.36	1.97	ND	2.51	0.17	6.48	0.23	4.32	1.25	0.84	ND	0.13	99.90
3.60	2.90	ND	2.49	0.19	2.50	0.28	2.70	1.60	0.30	ND	ND	99.30
4.13	1.83	ND	2.47	0.21	3.78	0.20	3.22	2.09	0.31	ND	0.08	100.64
2.70	3.50	2.45	2.10	0.17	ND	1.34	2.10	0.30	0.50	1.05	ND	96.30
25.60	1.89	ND	0.71	0.18	ND	ND	ND	ND	ND	ND	ND	78.00
3.01	3.20	ND	2.46	0.23	3.80	0.21	2.10	0.60	0.40	ND	ND	99.80
3.92	3.10	2.53	2.32	0.20	2.90	0.16	2.20	1.50	0.20	0.57	ND	100.70
3.05	2.03	ND	2.97	0.22	3.69	0.16	2.27	1.32	0.26	ND	0.09	100.83
4.19	3.30	ND	1.99	0.20	2.00	0.09	1.80	1.30	0.10	ND	ND	99.40
4.87	3.40	3.01	1.52	0.22	1.80	0.11	1.90	1.40	0.10	0.39	ND	98.20
4.10	3.30	2.84	1.75	0.17	2.10	0.13	1.90	1.50	0.10	0.46	ND	98.90
3.67	2.25	ND	1.95	0.20	3.24	0.00	2.61	1.59	0.28	ND	0.1	98.81
3.68	3.10	2.35	2.44	0.21	4.40	0.36	2.90	1.60	0.40	0.75	ND	99.50
4.21	3.10	2.35	2.36	0.20	3.70	0.14	2.90	0.00	0.00	0.75	ND	100.20
3.69	3.20	2.70	2.01	0.19	2.50	0.30	1.90	1.20	0.20	0.50	ND	99.60
4.31	3.30	2.84	1.95	0.19	2.10	0.17	2.10	1.40	0.20	0.46	ND	99.70
4.36	2.66	2.62	1.89	0.19	2.25	0.25	2.01	1.54	0.13	0.04	0.04	100.12
5.24	3.00	2.19	2.59	0.21	4.00	0.10	3.70	2.70	0.30	0.81	ND	99.40
3.53	3.10	2.49	2.30	0.19	3.10	0.14	2.20	1.20	0.30	0.61	ND	99.00
12.30	2.80	2.56	1.51	0.16	1.60	0.63	8.20	8.00	0.10	0.24	ND	99.90
3.74	3.60	3.16	1.51	0.18	1.90	0.39	1.50	1.00	0.10	0.44	ND	99.60
1.81	3.10	2.41	2.67	0.21	4.50	0.18	1.40	0.00	0.40	0.69	ND	99.30
3.85	3.50	3.12	1.50	0.17	2.30	0.96	1.70	1.00	0.20	0.38	ND	99.80
3.25	3.40	2.83	1.64	0.21	3.30	0.77	1.50	0.60	0.20	0.57	ND	100.60
4.12	3.00	2.37	2.49	0.18	3.90	0.26	3.20	1.80	0.40	0.63	ND	99.50
3.76	2.78	ND	1.58	0.19	2.43	0.50	1.72	1.21	0.14	ND	0.06	98.86
3.31	3.80	ND	1.74	0.18	2.90	0.20	1.20	0.60	0.20	ND	ND	0.00
1.44	3.30	2.52	2.65	0.19	4.40	0.15	1.30	0.00	0.40	0.78	ND	99.60
1.55	3.40	2.71	2.20	0.24	4.50	0.13	1.30	0.00	0.40	0.69	ND	100.20
2.32	3.70	3.23	1.65	0.19	ND	1.24	0.60	0.00	0.20	0.47	ND	98.40
1.94	3.60	2.98	2.10	0.19	3.10	0.51	1.00	0.00	0.30	0.62	ND	99.20
29.60	0.70	ND	0.26	0.45	5.70	0.12	24.20	23.10	0.30	ND	ND	0.00
29.90	1.20	0.85	0.55	0.45	3.40	0.14	23.50	23.60	0.00	0.35	ND	100.60
9.60	3.10	2.45	0.98	0.32	3.40	0.43	6.40	5.60	0.20	0.65	ND	98.90
1.65	3.40	ND	2.22	0.19	4.20	0.24	1.20	ND	ND	ND	ND	99.70
3.00	3.80	3.37	1.38	0.18	0.00	1.02	0.70	0.10	0.20	0.43	ND	97.90
1.27	2.09	ND	2.36	0.18	4.59	0.20	1.39	0.04	0.37	ND	0.08	99.86
1.76	3.50	2.87	2.02	0.20	4.30	0.17	1.10	0.00	0.30	0.63	ND	100.10
1.66	3.40	2.63	2.00	0.24	4.40	0.25	1.10	0.00	0.30	0.77	ND	99.10
1.86	3.50	2.83	1.95	0.27	3.70	0.23	1.10	0.00	0.30	0.67	ND	98.70
9.28	2.60	ND	1.39	0.17	0.00	1.53	6.70	5.90	0.20	ND	ND	98.70
8.30	2.80	2.21	2.08	0.19	3.70	0.24	6.40	5.30	0.30	0.59	ND	99.50

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Lithology	Induration	Moisture	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO
									wt%							
139	856A	09H	1	44	47	69.70	SLSN	moderate	9.1	ND	ND	ND	ND	ND	ND	ND
139	856A	09H	1	83	87	70.03	SLCY	moderate	ND	58.30	0.82	15.90	7.10	0.90	5.60	0.09
139	856A	09H	2	94	98	71.64	SLCY	moderate	ND	58.08	0.88	15.18	9.17	ND	ND	0.25
139	856A	09H	3	63	67	72.83	SLCY	moderate	28.4	60.10	0.81	15.30	7.10	0.90	5.60	0.06
139	856A	09H	4	115	117	74.85	SLCY	moderate	30.4	53.10	0.52	9.90	7.20	ND	ND	0.26
139	856A	09H	5	41	42	75.61	SILT	moderate	5.1	37.40	0.49	9.00	3.80	0.40	3.10	0.49
139	856A	09H	5	80	84	76.00	SLCY	moderate	30.5	57.90	0.84	15.80	7.40	1.20	5.60	0.08
139	856A	09H	7	59	63	78.79	SLCY	moderate	28.6	57.50	0.82	16.10	7.50	1.20	5.70	0.09
139	856A	10X	1	68	71	79.38	SILT	moderate	ND	59.50	0.84	15.78	7.36	ND	ND	0.10
139	856A	10X	2	119	122	81.39	SSSL	moderate	33.0	56.00	0.87	16.00	8.00	1.70	5.70	0.10
139	856A	10X	2	128	130	81.48	SLSC	moderate	23.4	61.90	0.79	15.40	6.20	1.40	4.30	0.07
139	856A	11X	1	70	72	86.90	SLSC	moderate	21.9	62.20	0.79	14.30	4.70	0.70	3.60	0.10
139	856A	11X	1	104	106	87.24	SAND	moderate	ND	63.61	0.72	13.34	3.89	ND	ND	0.15
139	856A	11X	2	47	48	88.17	SLCY	moderate	24.7	59.30	0.85	15.80	7.00	1.10	5.30	0.08
139	856A	12X	1	85	89	96.55	SLCY	moderate	ND	57.42	0.86	16.34	8.42	ND	ND	0.12
139	856A	12X	1	92	96	96.62	SLCY	moderate	27.0	58.90	0.80	15.50	7.30	1.10	5.60	0.10
139	856A	12X	2	20	24	97.40	SLCS	moderate	ND	61.20	0.82	15.30	6.30	0.70	5.00	0.08
139	856A	13X	2	13	16	106.93	SLCY	moderate	25.0	61.50	0.77	14.50	5.90	0.70	4.70	0.12
139	856A	13X	2	12	127	108.03	SLCY	moderate	ND	57.04	0.81	16.60	7.60	ND	ND	0.11
139	856A	13X	4	47	51	110.27	SLCY	moderate	26.9	60.30	0.80	15.30	6.40	0.70	5.10	0.10
139	856B	01H	1	102	106	1.02	SLCY	non	40.8	52.70	0.78	15.30	7.20	3.00	3.80	0.10
139	856B	01H	1	123	127	1.23	SLCY	non	ND	51.16	0.68	14.78	7.97	ND	ND	0.07
139	856B	02H	2	3	7	3.33	SILT	non	ND	63.90	0.59	14.50	5.70	1.40	3.90	0.08
139	856B	02H	3	45	49	5.25	SLCY	non	ND	59.36	0.89	16.31	8.34	ND	ND	0.10
139	856B	02H	5	115	119	8.95	SLCY	weak	35.7	57.90	0.84	15.70	7.00	0.70	5.70	0.11
139	856B	03H	5	23	25	17.53	SLCY	weak	35.7	57.20	0.87	16.00	8.10	1.10	6.30	0.06
139	856B	03H	5	110	113	18.40	SNSL	weak	9.8	1.03	0.01	0.23	61.70	ND	ND	0.01
139	856B	03H	5	120	122	18.50	SNSL	weak	33.0	9.20	0.13	2.56	49.50	ND	ND	0.08
139	856B	03H	5	142	144	18.72	SNSL	weak	26.6	6.92	0.09	1.96	50.50	ND	ND	0.04
139	856B	03H	6	34	36	19.14	SNSL	weak	31.7	5.62	0.05	1.15	57.30	ND	ND	0.04
139	856B	03H	7	6	8	20.36	SNSL	weak	32.2	7.23	0.08	1.67	46.70	ND	ND	0.13
139	856B	03H	7	28	30	20.58	SNCL	weak	36.3	8.94	0.10	2.03	50.30	ND	ND	0.11
139	856B	03H	7	32	34	20.62	SNCL	weak	42.9	15.40	0.20	3.94	44.50	ND	ND	0.07
139	856B	03H	CC	28	31	21.33	SNCL	weak	45.1	25.00	0.32	6.21	34.00	ND	ND	0.05
139	856B	04H	1	78	81	21.58	SNCL	weak	34.0	23.50	0.31	6.51	37.50	ND	ND	0.06
139	856B	04H	1	134	136	22.14	SNCL	weak	32.0	22.80	0.33	6.28	35.50	ND	ND	0.06
139	856B	04H	1	145	147	22.25	SNCL	weak	29.1	13.10	0.19	3.89	40.90	ND	ND	0.02
139	856B	04H	2	86	88	23.16	SLCY	weak	36.5	52.10	0.81	15.10	9.10	ND	ND	0.07
139	856B	04H	2	130	132	23.60	SLCY	weak	31.1	45.20	0.67	12.40	18.30	ND	ND	0.07
139	856B	04H	3	35	37	24.15	SLCY	weak	34.1	41.30	0.55	11.20	20.00	ND	ND	0.11
139	856B	04H	3	85	87	24.65	SLCY	weak	31.1	55.40	0.83	15.90	10.00	2.70	6.60	0.10
139	856B	04H	4	37	39	25.67	SLCY	weak	29.3	51.20	0.84	15.50	13.90	ND	ND	0.09
139	856B	04H	4	101	106	26.31	SLCY	weak	28.7	57.40	0.75	14.80	7.00	ND	ND	0.18
139	856B	04H	6	61	66	28.91	SLCY	weak	37.9	51.40	0.78	16.30	11.20	ND	ND	0.11
139	856B	05H	2	67	70	32.47	SLCY	weak	34.0	55.60	0.82	16.50	8.30	1.20	6.40	0.12
139	856B	05H	2	73	77	32.53	SLCY	weak	ND	60.81	0.90	15.96	7.22	ND	ND	0.10
139	856B	05H	4	51	57	35.31	SLCY	weak	33.0	56.40	0.80	16.40	7.60	0.70	6.20	0.10
139	856B	05H	6	92	97	38.72	SLCY	weak	27.5	56.30	0.83	16.10	7.80	0.80	6.30	0.10
139	856B	06H	2	23	29	41.53	SLCY	weak	29.5	55.70	0.83	16.30	8.40	1.40	6.30	0.11
139	856B	06H	2	104	108	42.34	SLCY	weak	32.4	54.60	0.79	16.80	8.30	1.40	6.20	0.11
139	856B	06H	4	25	29	44.55	SLCY	weak	30.3	57.30	0.86	16.10	7.80	0.90	6.20	0.09
139	856B	06H	4	124	128	45.54	SLCY	weak	30.0	55.70	0.85	16.60	8.10	ND	ND	0.11
139	856B	06H	6	12	16	47.42	SLCY	weak	28.0	57.90	0.84	15.30	7.40	ND	ND	0.08
139	856B	06H	6	118	122	48.48	SLCY	weak	29.2	56.50	0.84	16.10	7.80	0.60	6.50	0.09
139	856B	06H	6	130	132	48.60	SLCY	weak	ND	55.00	0.91	16.87	8.55	ND	ND	0.10
139	856B	07H	3	130	133	53.60	SILT	weak	ND	59.74	0.91	15.63	7.31	ND	ND	0.08
139	856B	07H	4	88	95	54.68	SLCY	weak	27.6	61.30	0.78	14.60	6.20	ND	ND	0.07
139	856B	07H	5	26	32	55.56	SLCY	weak	27.4	58.20	0.79	14.60	8.80	ND	ND	0.07
139	856B	07H	6	141	148	58.21	SLCY	weak	32.1	57.30	0.89	15.80	6.90	0.50	5.80	0.11
139	856B	08H	1	34	36	59.14	SNSL	weak	19.8	44.20	0.55	8.88	25.20	ND	ND	0.05
139	856B	08H	2	55	57	60.85	SAND	weak	33.7	74.07	0.80	11.79	3.06	ND	ND	0.05
139	856B	08H	3	55	57	62.35	SLCY	weak	ND	52.40	0.87	18.30	7.30	ND	ND	0.13
139	856B	09X	2	15	19	63.95	SLCY	weak	31.2	56.40	0.83	16.20	7.60	0.30	6.60	0.17
139	856B	09X	2	139	142	65.19	SLCY	weak	ND	54.78	0.96	16.82	8.28	ND	ND	0.23
139	856B	10X	2	54	58	72.84	SNSL	moderate	21.4	63.60	0.71	14.20	5.60	ND	ND	0.24
139	856B	11X	1	54	58	73.84	SLCY	moderate	23.3	63.30	0.97	14.70	5.50	0.40	4.60	0.15
139	856B	11X	3	93	97	77.23	SLCY	moderate	23.2	59.60	0.83	15.30	6.00	0.20	5.40	0.19
139	856B	11X	5	53	57	79.83	SLCY	moderate	21.6	59.90	0.80	15.00	6.40	ND	ND	0.19
139	856B	12X	2	42	46	83.52	SLSN	moderate	19.6	61.50	0.67	15.00	5.00	0.60	4.00	0.25
139	856B	12X	2	52	56	83.64	SAND	moderate	ND	62.47	0.71	14.99	5.50	ND	ND	0.26
139	856B	12X	3	12	16	84.72	SILT	moderate	ND	59.96	0.93	16.09	7.85	ND	ND	0.09
139	856B	12X	4	29	33	86.39	SAND	moderate	25.5	63.10	0.86	14.00	5.60	ND	ND	0.25
139	856B	12X	CC	18	22	89.30	SLCY	indurated	21.4	65.90	0.61	13.00	4.60	ND	ND	0.34
139	856B	13X	2	63	67	93.23	SLST	indurated	23.1	55.30	0.81	15.50	7.10	ND	ND	0.78
139	856B	13X	4	109	113	96.69	SLCY	indurated	ND	58.50	0.84	15.85	6.05	ND	ND	0.68
139	856B	13X	4	128	132	96.88	SLCY	indurated	21.9	60.40	0.77	15.10	5.70	ND	ND	0.61
139	856B	14X	1	34	36	101.14	SLST	indurated	20.2	55.40	0.73	13.90	10.60	ND	ND	0.56
139	856B	14X	3	76	79	104.56	SLST	indurated	23.5	57.00	0.99	15.20	9.60	ND	ND	0.55
139	856B	14X	4	50	53	105.80	SLST	indurated	21.3	61.60	0.73	14.60	7.20	0.40	6.10	0.43
139	856B	15X	1	48	50	110.88	SLST	indurated	18.4	54.60	0.79	15.50	15.40	ND	ND	0.42
139	856B	15X	1	91	93	111.31	SILT	indurated	18.8	58.70	0.66	15.40	13.20	ND	ND	0.24
139	856B	15X	1	124	126	111.64	SILT	indurated	3.7	60.60	0.53	8.50	20.70	ND	ND	0.15
139	856B	15X	2	27	29	112.17	SLCY	indurated	20.0	53.70	0.89	15.70	16.40	ND	ND	0.32
139	856B	15X	2	67												

Table 1 (continued).

MgO	CaO	Na ₂ O	Na ₂ OC	K ₂ O	P ₂₁₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC	Na ₂ OX	N	Total
wt%													
ND	ND	ND	0.00	ND	ND	ND	ND	ND	ND	ND	0.32	ND	ND
4.67	2.36	3.40	2.67	2.07	0.21	3.50	0.15	1.50	0.30	0.30	0.73	ND	99.60
8.76	0.36	1.95	ND	1.16	0.22	3.42	0.00	0.00	0.04	0.18	ND	0.09	97.58
4.72	1.28	3.00	2.27	2.32	0.17	4.10	0.09	1.10	0.00	0.30	0.73	ND	99.70
1.76	10.90	2.40	2.12	1.26	0.12	0.00	3.60	7.90	7.00	0.20	0.28	ND	99.00
2.18	22.90	1.90	1.64	1.27	0.18	2.10	0.60	17.60	16.90	0.20	0.26	ND	99.70
5.06	1.74	3.20	2.47	2.21	0.24	4.10	0.32	1.10	0.00	0.30	0.73	ND	99.50
5.42	1.67	3.40	2.74	1.96	0.19	4.50	0.16	1.00	0.00	0.30	0.66	ND	99.80
5.55	1.60	2.46	ND	1.88	0.19	2.70	0.56	0.63	0.04	0.16	ND	0.05	100.06
5.71	2.08	3.70	2.86	1.76	0.48	4.40	0.15	0.90	0.00	0.20	0.84	ND	99.70
3.81	2.83	3.90	3.39	1.39	0.26	2.60	0.18	0.50	0.00	0.10	0.51	ND	99.50
2.50	4.62	3.50	3.04	1.54	0.20	2.00	0.30	2.10	1.60	0.10	0.46	ND	98.60
1.60	7.00	2.84	ND	1.49	0.17	1.89	0.30	0.00	0.00	0.16	ND	0.07	98.51
4.96	1.54	3.20	2.66	2.13	0.19	3.80	0.24	1.10	0.00	0.30	0.54	ND	99.80
7.52	0.79	2.02	ND	2.20	0.19	4.50	0.17	0.88	0.04	0.23	ND	0.1	99.78
5.54	1.18	3.20	2.62	2.01	0.30	4.40	0.56	0.80	0.00	0.20	0.58	ND	100.10
4.83	1.37	3.10	ND	1.91	0.23	4.20	0.25	0.70	0.00	0.20	ND	ND	99.90
5.83	1.20	3.60	3.10	1.62	0.20	3.50	0.38	0.40	0.00	0.10	0.50	ND	99.10
7.77	0.53	1.95	ND	2.31	0.17	5.31	0.29	1.03	0.04	0.27	ND	0.09	100.37
6.27	1.07	3.60	3.11	1.07	0.21	3.70	0.25	0.50	0.13	0.10	0.49	ND	99.10
3.81	6.18	3.80	2.59	2.06	0.18	4.00	0.13	4.20	2.40	0.50	1.21	ND	100.20
3.64	7.72	1.81	ND	2.55	0.14	5.22	0.42	0.00	4.73	0.63	ND	0.05	97.65
2.70	4.02	3.40	2.73	1.89	0.15	1.50	0.50	0.40	0.00	0.10	0.67	ND	99.10
3.86	3.41	2.52	ND	2.27	0.18	2.70	1.19	0.88	0.07	0.22	ND	0.02	98.30
3.91	3.21	3.70	2.89	1.75	0.18	3.40	0.91	1.70	0.00	0.50	0.81	ND	99.80
5.48	1.93	3.80	2.95	0.79	0.25	4.10	0.09	0.90	0.00	0.20	0.85	ND	99.00
0.54	0.14	0.20	0.19	0.09	0.04	ND	45.00	0.40	0.00	0.10	0.01	ND	111.30
5.45	1.40	1.00	0.11	0.23	0.74	ND	31.10	0.50	0.00	0.10	0.89	ND	106.90
3.29	0.32	0.86	0.12	0.22	0.13	ND	37.00	0.50	0.00	0.10	0.74	ND	109.10
3.88	0.31	0.68	0.00	0.24	0.07	ND	30.20	0.40	0.00	0.10	0.80	ND	104.50
3.66	2.53	0.89	0.01	0.27	0.21	ND	29.00	0.90	0.30	0.20	0.88	ND	96.40
2.88	0.41	1.16	0.08	0.29	0.18	ND	36.00	0.60	0.00	0.20	1.08	ND	106.20
4.10	0.37	1.70	0.31	0.42	0.15	ND	26.30	0.70	0.00	0.20	1.39	ND	100.40
5.50	0.50	2.29	ND	0.63	0.23	ND	19.40	0.70	0.00	0.20	ND	ND	98.10
4.70	0.97	1.70	0.66	0.77	0.54	ND	23.50	0.90	0.00	0.20	1.04	ND	104.10
6.12	0.39	1.38	0.45	0.56	0.18	ND	24.10	0.90	0.00	0.20	0.93	ND	101.80
2.96	0.49	1.07	0.23	0.54	0.20	ND	31.80	0.90	0.00	0.20	0.84	ND	100.90
4.65	0.84	3.10	2.09	2.13	0.17	ND	3.71	1.10	0.00	0.30	1.01	ND	93.30
5.66	0.74	2.49	1.57	1.29	0.24	ND	9.80	0.90	0.00	0.20	0.92	ND	98.70
6.56	0.60	2.11	1.14	1.27	0.16	ND	9.40	1.30	0.00	0.40	0.97	ND	96.80
4.77	1.25	3.30	2.64	2.56	0.18	4.50	0.85	1.30	0.00	0.40	0.66	ND	100.50
5.84	1.47	3.50	2.72	1.83	0.31	ND	2.18	1.10	0.00	0.30	0.78	ND	98.00
5.27	3.77	3.50	ND	1.90	0.39	ND	1.54	0.70	0.00	0.20	ND	ND	97.40
5.42	0.76	2.80	2.09	3.38	0.17	ND	3.26	1.30	0.00	0.40	0.71	ND	97.00
6.23	0.75	2.90	2.02	2.93	0.19	4.70	0.31	1.20	0.00	0.30	0.88	ND	100.00
5.21	0.92	2.22	ND	2.88	0.19	4.14	1.06	1.06	0.99	0.02	ND	0.02	99.61
6.45	0.60	2.80	1.96	2.76	0.18	4.00	0.50	0.80	0.00	0.20	0.84	ND	98.90
6.31	0.41	2.30	1.56	3.15	0.19	4.10	0.42	1.10	0.00	0.30	0.74	ND	98.60
6.94	0.34	2.20	1.46	3.01	0.18	5.30	0.49	1.10	0.00	0.30	0.74	ND	100.30
7.24	0.35	2.20	1.32	3.37	0.19	4.90	0.60	0.80	0.00	0.20	0.88	ND	99.70
6.58	0.47	2.30	1.64	2.92	0.28	4.60	0.58	0.90	0.00	0.20	0.66	ND	100.20
7.08	0.35	2.20	ND	2.74	0.20	ND	1.32	1.00	0.00	0.30	ND	ND	96.40
6.17	0.43	2.30	1.57	2.32	0.24	4.40	0.86	0.90	0.00	0.20	0.73	ND	99.30
6.71	0.34	2.10	1.39	2.66	0.20	5.10	0.85	1.20	0.00	0.30	0.71	ND	99.90
8.23	0.34	1.18	ND	2.75	0.20	7.02	0.63	6.81	0.04	1.85	ND	0.29	100.68
7.36	0.32	1.37	ND	2.04	0.19	4.50	1.16	1.24	0.11	0.31	ND	0.05	99.54
6.57	0.37	1.90	1.25	2.15	0.23	ND	1.12	0.90	0.17	0.20	0.65	ND	96.30
5.84	0.29	1.90	1.29	2.15	0.18	ND	3.50	1.00	0.00	0.30	0.61	ND	97.50
7.44	0.35	2.20	1.46	2.00	0.21	4.90	0.72	1.00	0.00	0.30	0.74	ND	99.30
3.18	0.37	1.93	1.59	1.08	0.16	0.00	17.90	0.50	0.00	0.10	0.34	ND	104.10
3.44	0.36	2.55	ND	1.08	0.18	2.61	0.35	0.44	0.07	0.10	ND	0.02	100.44
9.35	0.41	1.20	ND	2.48	0.24	5.80	0.30	0.90	ND	ND	ND	ND	99.80
8.21	0.38	1.70	0.99	1.66	0.19	5.80	0.93	1.00	0.00	0.30	0.71	ND	100.40
9.32	0.45	0.28	ND	2.38	0.23	6.12	1.28	0.11	0.11	0.00	ND	0.03	99.74
5.85	0.31	3.50	3.01	0.74	0.17	ND	1.74	0.20	ND	ND	0.49	ND	97.00
5.67	0.45	3.30	2.75	1.13	0.26	3.70	0.75	0.40	0.00	0.10	0.55	ND	99.80
7.13	0.42	3.60	2.97	0.83	0.25	4.60	0.87	0.50	0.00	0.10	0.63	ND	99.60
7.21	0.37	2.80	2.33	1.05	0.22	0.00	1.12	0.60	0.00	0.20	0.47	ND	95.70
7.78	0.31	3.50	3.08	0.74	0.18	4.50	0.05	0.20	ND	ND	0.42	ND	99.30
7.45	0.36	3.16	ND	0.71	0.17	3.78	1.48	0.00	0.04	0.07	ND	0	99.56
5.35	1.36	2.25	ND	2.28	0.16	5.40	1.55	ND	0.00	ND	ND	0.01	100.99
5.87	0.36	3.80	3.27	0.74	0.21	ND	1.36	0.40	0.00	0.10	0.53	ND	96.60
5.64	0.27	3.40	3.05	0.59	0.16	ND	1.59	0.80	0.00	0.20	0.35	ND	97.00
8.35	0.39	4.10	3.53	0.55	0.24	ND	2.37	0.30	0.00	0.10	0.57	ND	95.90
8.47	0.41	3.05	ND	0.67	0.24	4.05	0.73	ND	0.04	ND	ND	0.01	99.98
6.88	0.35	3.90	3.48	0.71	0.19	4.30	0.80	0.50	0.00	0.10	0.42	ND	100.30
7.11	0.38	0.50	0.00	2.06	0.27	ND	4.56	0.30	0.00	0.10	0.51	ND	96.50
8.39	0.31	0.60	0.11	1.03	0.22	ND	1.95	0.40	0.00	0.10	0.49	ND	96.30
7.91	0.25	0.50	0.10	0.53	0.18	5.90	0.12	0.50	0.00	0.10	0.40	ND	99.80
5.44	0.23	0.50	0.08	1.38	0.15	ND	1.01	0.60	0.00	0.20	0.42	ND	96.20
4.29	0.18	0.50	0.08	1.68	0.11	ND	1.39	0.50	0.00	0.10	0.42	ND	97.20
1.84	0.20	0.20	0.11	0.05	0.13	ND	4.81	0.20	0.00	0.00	0.09	ND	100.40
4.70	0.44	0.60	0.16	1.54	0.28	ND	1.84	0.50	0.00	0.10	0.44	ND	97.00
1.31	0.20	0.20	0.15	1.32	0.13	ND	2.33	0.10	0.00	0.00	0.05	ND	99.00
2.74	0.30	0.60	0.20	2.06	0.20	ND	1.21	0.70	0.00	0.20	0.40	ND	97.60
1.86	0.21	0.30	0.10	1.45	0.14	ND	1.26	0.30	0.00	0.10	0.20	ND	97.80
1.92	0.19	0.30	0.17	1.84	0.12	ND	1.11	0.10	0.00	0.00	0.13	ND	98.20
10.29	0.17	0.00	ND	1.65	0.04	8.10	5.48	0.48	0.07	0.20	ND	0.01	100.19

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Lithology	Induration	Moisture	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO
									wt%							
139	856B	15X	3	122	124	114.62	SILT	indurated	9.3	68.30	0.65	10.70	13.10	1.90	10.10	0.24
139	856B	15X	4	12	14	115.02	SLSN	indurated	2.2	67.40	0.64	14.40	8.80	0.70	7.30	0.07
139	856B	15X	4	70	72	115.60	SLCY	moderate	19.4	56.80	0.85	16.00	14.00	ND	ND	0.26
139	856B	15X	4	130	132	116.20	SLCY	moderate	31.3	26.00	1.08	16.30	18.60	ND	ND	0.25
139	856B	15X	5	8	10	116.48	SLCY	moderate	33.3	39.00	1.08	23.70	13.50	1.50	10.80	0.15
139	856B	15X	5	76	78	117.16	SLSC	moderate	14.6	59.40	0.74	13.40	10.60	ND	ND	0.13
139	856B	15X	5	106	108	117.46	SILT	indurated	90.9	66.80	0.63	12.20	7.60	1.00	5.90	0.07
139	856B	15X	6	6	8	117.96	SILT	indurated	13.4	56.70	0.77	13.50	6.30	1.20	4.60	0.04
139	856B	15X	CC	20	22	118.22	SILT	indurated	11.6	64.00	0.44	11.20	7.14	ND	ND	0.03
139	856D	01H	1	3	6	0.03	SNCL	non	23.8	2.59	0.01	0.10	59.00	ND	ND	0.09
139	856D	01H	1	15	18	0.15	SNCL	non	21.1	3.30	0.01	0.10	58.30	ND	ND	0.11
139	856D	01H	1	34	37	0.34	SNCL	non	13.7	0.71	0.01	0.10	32.10	ND	ND	0.08
139	856D	01H	1	39	42	0.39	SNCL	non	15.0	1.76	0.01	0.10	57.90	ND	ND	0.11
139	856D	01H	1	66	69	0.66	SNCL	non	31.6	20.00	0.01	0.20	40.90	ND	ND	0.04
139	856D	01H	1	89	93	0.89	SNCL	non	23.7	39.70	0.01	0.23	27.50	ND	ND	0.04
139	856D	01H	1	112	115	1.12	SNCL	non	24.1	37.10	0.01	0.29	29.80	ND	ND	0.04
139	856D	01H	1	135	138	1.35	SNCL	non	14.6	32.10	0.01	0.24	28.60	ND	ND	0.05
139	856D	01H	2	10	14	1.60	SNCL	non	30.5	24.00	0.01	0.26	36.20	ND	ND	0.07
139	856D	01H	2	43	46	1.93	SNCL	non	12.5	60.80	0.01	0.10	13.50	ND	ND	0.03
139	856D	01H	2	57	59	2.07	SNCL	non	12.6	68.80	0.01	0.39	14.30	ND	ND	0.02
139	856D	01H	3	16	20	3.16	SNCL	non	31.0	17.90	0.01	0.32	41.70	ND	ND	0.03
139	856D	01H	3	32	36	3.32	SNCL	non	34.5	15.30	0.01	0.24	43.70	ND	ND	0.03
139	856D	01H	3	90	94	3.90	SNCL	non	28.9	18.00	0.01	0.25	43.40	ND	ND	0.03
139	856D	01H	3	121	124	4.21	SNCL	non	27.0	18.80	0.01	0.10	40.50	ND	ND	0.03
139	856D	01H	4	25	28	4.75	SNCL	non	27.3	19.90	0.01	0.10	38.50	ND	ND	0.03
139	856D	01H	4	114	116	5.64	SNCL	non	25.9	20.70	0.01	0.22	41.20	ND	ND	0.04
139	856D	01H	4	145	148	5.95	SNCL	non	19.7	33.70	0.01	0.10	34.30	ND	ND	0.04
139	856D	01H	5	54	57	6.54	SNCL	non	22.9	26.50	0.01	0.10	39.70	ND	ND	0.03
139	856D	01H	5	66	69	6.66	SNCL	non	23.1	22.70	0.01	0.10	36.70	ND	ND	0.05
139	856D	01H	5	88	91	6.88	SNCL	indurated	2.7	49.00	0.01	0.20	29.20	ND	ND	0.04
139	856D	01H	7	46	48	7.89	SNCL	non	17.5	6.33	0.01	0.10	50.10	ND	ND	0.04
139	856D	01H	7	70	71	8.13	SNCL	non	4.6	6.49	0.01	0.10	52.70	ND	ND	0.04
139	856E	01H	1	48	50	0.48	SLCY	non	52.4	34.10	0.42	8.14	20.90	ND	ND	0.10
139	856E	01H	1	73	75	0.73	SLCY	non	55.1	41.40	0.62	12.40	22.30	ND	ND	0.09
139	856E	01H	1	90	92	0.90	SLCY	non	43.0	45.10	0.70	11.80	17.10	ND	ND	0.13
139	856E	01H	1	96	98	0.96	SNSL	non	39.7	18.60	0.27	5.63	35.00	ND	ND	0.31
139	856E	01H	1	129	131	1.29	SNSL	non	23.6	0.68	0.01	0.23	24.30	ND	ND	0.38
139	856E	01H	2	55	57	2.05	SNSL	non	19.8	0.25	0.01	0.10	22.90	ND	ND	0.34
139	856F	02X	CC	23	25	11.93	SAND	indurated	1.4	6.28	0.01	0.10	42.10	ND	ND	0.14
139	856G	01R	3	84	86	3.84	SNSL	weak	26.3	0.25	0.01	0.10	61.20	ND	ND	0.04
139	856G	01R	3	112	114	4.12	SNSL	weak	24.0	0.75	0.01	0.10	61.00	ND	ND	0.10
139	856G	02R	2	54	56	10.64	SAND	indurated	3.7	71.60	0.01	0.22	7.47	ND	ND	0.03
139	856G	03R	1	12	14	17.72	SUL	indurated	ND	52.90	0.01	0.01	30.20	ND	ND	0.03
139	856G	03R	1	30	32	17.90	SUL	indurated	ND	3.96	0.01	0.49	62.10	ND	ND	0.06
139	856G	03R	1	35	37	17.95	SUL	indurated	ND	4.32	0.03	0.20	58.30	ND	ND	0.05
139	856G	03R	1	81	84	18.41	SUL	indurated	0.0	3.72	0.04	0.57	64.20	ND	ND	0.02
139	856G	04R	1	83	85	27.83	SUL	indurated	0.0	0.25	0.01	0.10	74.00	ND	ND	0.01
139	856G	05R	1	34	36	37.04	SUL	indurated	ND	8.48	0.01	0.59	59.80	ND	ND	0.05
139	856G	05R	1	59	61	37.29	SUL	indurated	0.0	6.13	0.01	0.24	46.10	ND	ND	0.07
139	856G	06R	1	19	21	46.49	SUL	indurated	ND	1.61	0.01	0.10	60.50	ND	ND	0.02
139	856G	06R	1	24	28	46.54	SUL	indurated	ND	1.84	0.01	0.10	58.40	ND	ND	0.01
139	856G	06R	1	71	73	47.01	SUL	indurated	0.0	9.33	0.01	0.10	58.20	ND	ND	0.02
139	856G	06R	2	80	82	48.60	SUL	indurated	ND	2.47	0.01	0.10	68.20	ND	ND	0.02
139	856G	06R	2	87	89	48.67	SUL	indurated	0.0	1.75	0.01	0.10	61.40	ND	ND	0.11
139	856G	06R	3	13	16	49.43	SUL	indurated	ND	3.55	0.01	0.10	65.10	ND	ND	0.02
139	856G	06R	3	17	19	49.47	SUL	indurated	0.0	3.93	0.01	0.10	65.00	ND	ND	0.02
139	856G	06R	3	87	89	50.17	SUL	indurated	0.0	9.80	0.01	0.10	58.10	ND	ND	0.02
139	856G	06R	3	129	131	50.59	SUL	indurated	ND	4.15	0.01	0.10	54.60	ND	ND	0.09
139	856G	06R	3	132	134	50.62	SUL	indurated	0.0	2.16	0.01	0.10	48.10	ND	ND	0.15
139	856G	07R	1	1	3	55.81	SUL	indurated	0.0	2.24	0.01	0.10	55.90	ND	ND	0.12
139	856G	07R	1	21	23	56.01	SUL	indurated	ND	0.83	0.01	0.10	57.60	ND	ND	0.14
139	856G	07R	1	42	43	56.22	SUL	indurated	ND	11.20	0.01	0.10	29.60	ND	ND	0.06
139	856G	07R	1	46	47	56.26	SUL	indurated	ND	0.97	0.01	0.10	78.80	ND	ND	0.01
139	856G	07R	2	46	48	57.66	SUL	indurated	ND	7.35	0.01	0.10	58.30	ND	ND	0.01
139	856G	07R	2	120	122	58.40	SUL	indurated	ND	15.00	0.01	0.10	43.00	ND	ND	0.06
139	856G	07R	3	103	106	59.72	SUL	indurated	ND	3.88	0.01	0.10	62.20	ND	ND	0.02
139	856G	07R	3	103	106	59.72	SUL	indurated	ND	3.73	0.01	0.10	66.70	ND	ND	0.01
139	856G	07R	3	123	125	59.92	SUL	indurated	ND	1.48	0.01	0.10	60.30	ND	ND	0.01
139	856G	07R	4	35	37	60.45	SUL	indurated	ND	1.29	0.01	0.10	61.70	ND	ND	0.01
139	856H	03R	1	28	30	22.38	SUL	indurated	ND	2.04	0.01	1.10	52.00	ND	ND	0.03
139	856H	03R	1	38	40	22.48	SUL	indurated	ND	1.29	0.01	0.10	60.30	ND	ND	0.02
139	856H	03R	1	60	62	22.70	SUL	indurated	ND	2.15	0.01	0.10	63.20	ND	ND	0.02
139	856H	03R	1	75	77	24.01	SUL	indurated	ND	1.80	0.01	0.10	52.70	ND	ND	0.03
139	856H	03R	2	16	18	23.42	SUL	indurated	ND	3.20	0.01	0.21	53.20	ND	ND	0.03
139	856H	03R	2	84	87	24.10	SUL	indurated	ND	4.40	0.01	0.10	51.60	ND	ND	0.05
139	856H	03R	2	135	138	24.61	SUL	indurated	ND	1.67	0.01	0.10	68.30	ND	ND	0.02
139	856H	03R	3	17	19	24.88	SUL	indurated	ND	4.43	0.01	0.10	58.70	ND	ND	0.03
139	856H	03R	3	72	74	25.43	SUL	indurated	ND	4.58	0.07	1.31	63.70	ND	ND	0.04
139	856H	04R	1	21	23	26.81	SUL	indurated	ND	14.40	0.22	3.92	46.10	ND	ND	0.06
139	856H	04R	1	65	67	27.25	SUL	indurated	ND	6.06	0.10	2.73	58.30	ND	ND	0.06
139	856H	04R	1	88	90	27.48	SUL	indurated	ND	33.40	0.04	1.31	47.70	ND	ND	0.02
139	856H	04R	1	124	126	27.84	SUL	indurated	ND	1.89	0.01	0.36	79.00	ND	ND	0.02
139	856H	04R	1	135	137	27.95	SUL	indurated	ND	2.96	0.01	0.33	64.70	ND	ND	0.01
139	856H	04R	2	6	8	28.16	SUL	indurated	ND	4.10	0.03	1.61	57.70	ND	ND	0.05
139	856H	04R	2	17	19	28.27	SUL	indurated	ND	0.25	0.01	0.10	79.90	ND	ND	0.01
139	856H	04														

Table 1 (continued).

MgO	CaO	Na ₂ O	Na ₂ OC	K ₂ O	P ₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC	Na ₂ OX	N	Total
wt%													
2.96	0.32	0.30	0.08	0.66	0.20	3.90	0.49	0.20	ND	ND	0.22	ND	101.20
2.18	0.23	0.50	0.32	2.01	0.15	3.40	0.52	0.20	ND	ND	0.18	ND	99.80
5.05	0.27	0.60	0.17	1.78	0.19	ND	1.06	0.40	0.00	0.10	0.43	ND	97.40
8.12	7.84	1.06	0.18	1.45	0.15	ND	5.80	0.30	0.00	0.10	0.88	ND	87.30
9.40	0.49	1.20	0.59	3.28	0.14	7.50	0.61	0.40	0.00	0.10	0.61	ND	99.60
5.08	1.94	0.50	0.14	1.19	0.17	ND	1.25	0.30	0.00	0.10	0.36	ND	95.00
4.84	0.73	0.40	0.14	0.73	0.10	4.30	0.70	0.10	ND	ND	0.26	ND	99.00
10.30	0.00	0.60	0.17	0.09	0.23	7.30	0.90	0.40	0.00	0.10	0.43	ND	96.60
4.77	1.21	2.75	2.55	0.16	0.07	ND	2.46	0.20	ND	ND	0.20	ND	95.20
0.81	0.15	0.45	0.10	0.12	0.01	ND	44.50	0.40	0.00	0.10	0.35	ND	110.80
0.88	0.15	0.38	0.16	0.08	0.04	ND	44.10	0.30	0.00	0.10	0.22	ND	111.60
0.25	0.14	0.34	0.11	0.05	0.03	ND	42.50	0.30	0.00	0.10	0.23	ND	84.80
0.40	0.15	0.24	0.15	0.06	0.01	ND	45.00	0.40	0.00	0.10	0.09	ND	110.20
9.90	0.20	0.70	0.00	0.16	0.08	ND	32.10	0.20	ND	ND	0.78	ND	107.80
11.70	0.19	0.64	0.01	0.16	0.08	ND	21.80	0.10	ND	ND	0.63	ND	105.10
11.10	0.17	0.59	0.00	0.13	0.05	ND	23.40	0.10	ND	ND	0.59	ND	106.10
15.40	0.17	0.71	0.04	0.15	0.06	ND	22.00	0.20	ND	ND	0.67	ND	103.20
12.10	0.18	0.68	0.00	0.18	0.08	ND	28.80	0.10	ND	ND	0.74	ND	106.60
8.14	0.15	0.49	0.15	0.05	0.07	ND	11.20	0.10	ND	ND	0.34	ND	98.50
4.01	0.17	0.44	0.18	0.05	0.07	ND	11.10	0.10	ND	ND	0.26	ND	101.00
8.74	0.24	0.72	0.00	0.14	0.08	ND	33.40	0.10	ND	ND	0.73	ND	107.80
7.59	0.19	0.69	0.00	0.13	0.05	ND	35.70	0.10	ND	ND	0.75	ND	109.00
8.67	0.24	0.61	0.02	0.09	0.08	ND	34.00	0.10	ND	ND	0.59	ND	109.60
8.85	0.21	0.59	0.00	0.14	0.07	ND	32.40	0.10	ND	ND	0.63	ND	105.80
9.21	0.23	0.62	0.00	0.12	0.06	ND	33.60	0.10	ND	ND	0.66	ND	106.60
7.90	0.28	0.61	0.00	0.13	0.12	ND	32.70	0.05	ND	ND	0.63	ND	108.00
6.56	0.23	0.48	0.01	0.09	0.11	ND	26.40	0.10	ND	ND	0.47	ND	106.70
5.47	0.20	0.56	0.01	0.12	0.06	ND	31.10	0.10	ND	ND	0.55	ND	108.70
5.77	0.18	0.57	0.06	0.15	0.06	ND	30.80	0.10	ND	ND	0.51	ND	105.50
4.28	0.15	0.26	0.14	0.05	0.06	ND	22.20	0.05	ND	ND	0.12	ND	108.20
1.58	0.20	0.32	0.00	0.07	0.06	ND	41.40	0.10	ND	ND	0.34	ND	107.80
1.39	0.19	0.28	ND	0.07	0.07	ND	40.40	0.20	ND	ND	0.28	ND	107.40
2.63	1.32	2.81	0.83	1.51	0.18	ND	12.60	2.70	0.00	0.70	1.98	ND	94.10
3.23	1.52	3.90	ND	2.19	0.58	ND	2.40	0.80	0.00	0.20	ND	ND	92.60
2.96	2.07	3.16	2.01	1.77	0.27	ND	7.50	0.80	0.00	0.20	1.15	ND	95.70
1.60	0.84	1.74	0.76	0.97	0.08	ND	28.40	1.40	0.00	0.40	0.98	ND	103.90
0.23	0.15	0.63	0.51	0.25	0.00	ND	40.20	0.50	0.00	0.10	0.12	ND	78.60
0.15	0.13	0.47	0.42	0.25	0.01	ND	44.20	0.30	0.00	0.10	0.05	ND	74.70
9.42	6.69	0.19	0.06	0.05	0.03	ND	24.20	14.10	11.90	0.60	0.13	ND	105.50
0.22	0.12	0.44	0.09	0.12	0.05	ND	47.60	0.30	0.00	0.10	0.35	ND	111.50
0.32	0.13	0.45	0.10	0.11	0.05	ND	47.20	0.20	ND	ND	0.35	ND	111.30
10.90	0.11	0.22	0.09	0.06	0.06	ND	5.00	0.10	ND	ND	0.13	ND	96.50
2.36	0.12	0.11	ND	0.25	0.07	ND	22.10	0.20	ND	ND	ND	ND	108.80
3.94	2.72	0.12	ND	0.25	0.05	ND	31.80	4.40	ND	ND	ND	ND	111.70
4.71	3.78	0.10	ND	0.00	0.06	ND	30.00	5.70	ND	ND	ND	ND	109.00
2.44	0.87	0.16	0.11	0.05	0.06	ND	34.10	1.20	0.50	0.20	0.05	ND	108.10
0.31	0.14	0.12	ND	0.25	0.01	ND	35.40	1.30	0.70	0.20	ND	ND	112.30
6.41	0.58	0.22	ND	0.08	0.26	ND	23.40	7.00	ND	ND	ND	ND	107.10
9.90	4.44	0.17	0.05	0.06	0.13	ND	23.00	14.50	13.10	0.40	0.12	ND	105.00
1.24	0.13	0.10	0.07	0.25	0.00	ND	48.40	0.30	0.00	0.10	0.03	ND	112.90
1.69	0.05	0.08	ND	0.05	0.02	ND	48.70	0.30	ND	ND	ND	ND	111.30
4.57	0.57	0.14	0.13	0.25	0.03	ND	36.80	0.90	0.53	0.10	0.01	ND	110.90
2.15	0.08	0.11	ND	0.08	0.03	ND	37.70	0.20	ND	ND	ND	ND	111.30
4.86	1.45	0.19	0.16	0.08	0.03	ND	34.80	4.86	3.40	0.40	0.03	ND	105.80
3.52	0.34	0.15	ND	0.08	0.05	ND	35.90	3.20	ND	ND	ND	ND	112.10
3.55	0.19	0.16	ND	0.05	0.02	ND	36.00	1.23	0.50	0.20	ND	ND	114.50
8.41	0.12	0.19	0.00	0.07	0.04	ND	29.30	1.10	0.73	0.10	0.22	ND	107.80
7.95	0.74	0.16	ND	0.08	0.06	ND	33.80	7.80	ND	ND	ND	ND	109.80
12.70	0.32	0.10	0.05	0.25	0.05	ND	29.40	14.66	11.00	1.00	0.05	ND	93.40
8.93	0.30	0.14	0.11	0.05	0.06	ND	31.20	15.40	7.90	0.60	0.03	ND	115.00
10.60	0.35	0.22	ND	0.13	0.05	ND	30.50	13.00	ND	ND	ND	ND	113.80
10.50	0.61	0.22	ND	0.25	0.05	ND	37.80	1.00	ND	ND	ND	ND	92.60
0.87	0.07	0.12	ND	0.05	0.05	ND	36.10	0.10	ND	ND	ND	ND	118.40
3.61	0.07	0.12	ND	0.25	0.06	ND	43.10	0.50	ND	ND	ND	ND	113.90
9.19	1.23	0.19	0.10	0.05	0.08	ND	26.60	8.20	5.00	0.20	0.09	ND	108.10
1.93	0.07	0.14	ND	0.06	0.03	ND	47.10	0.20	ND	ND	ND	ND	116.40
2.67	0.10	0.13	ND	0.06	0.03	ND	34.10	0.40	ND	ND	ND	ND	108.60
1.13	0.10	0.15	ND	0.25	0.05	ND	47.00	0.30	0.00	0.10	ND	ND	114.30
1.12	0.11	0.15	0.14	0.05	0.02	ND	47.50	0.40	0.00	0.10	0.01	ND	114.60
5.13	6.14	0.19	0.12	0.07	0.12	ND	28.70	9.10	8.40	0.20	0.07	ND	109.10
2.83	3.48	0.11	ND	0.05	0.25	ND	32.40	5.00	ND	ND	ND	ND	110.10
2.54	2.23	0.13	0.09	0.05	0.06	ND	33.30	3.70	1.80	0.50	0.04	ND	110.60
4.06	4.48	0.12	ND	0.06	0.10	ND	31.40	7.10	ND	ND	ND	ND	109.50
5.75	6.01	0.14	0.07	0.07	0.05	ND	28.40	8.80	7.50	0.40	0.07	ND	110.30
4.89	4.51	0.12	0.08	0.05	0.13	ND	30.70	6.70	5.40	0.40	0.04	ND	110.10
2.13	1.71	0.14	0.11	0.25	0.06	ND	33.00	2.40	1.60	0.20	0.03	ND	113.60
4.25	3.22	0.13	0.06	0.05	0.11	ND	29.70	4.50	3.20	0.40	0.07	ND	108.40
3.62	1.34	0.14	0.11	0.25	0.04	ND	29.80	4.50	1.20	0.90	0.03	ND	111.10
8.26	1.15	0.29	0.09	0.05	0.04	ND	26.00	1.60	0.90	0.20	0.20	ND	104.80
4.70	1.30	0.12	ND	0.06	0.06	ND	29.20	1.90	ND	ND	ND	ND	108.60
3.58	0.19	0.16	0.12	0.03	0.08	ND	21.80	0.10	ND	ND	0.04	ND	111.40
1.20	0.09	0.09	ND	0.05	0.04	ND	35.70	0.50	ND	ND	ND	ND	120.50
1.74	0.16	0.15	ND	0.03	0.03	ND	41.00	0.20	ND	ND	ND	ND	112.70
3.65	0.31	0.14	0.09	0.03	0.06	ND	31.50	1.80	1.10	0.20	0.05	ND	108.20
0.10	0.07	0.08	0.08	0.03	0.05	ND	35.80	ND	ND	ND	0.00	ND	117.00
1.85	0.19	0.13	0.04	0.03	0.04	ND	31.80	0.70	0.00	0.20	0.09	ND	107.60
3.66	0.48	0.11	ND	0.06	0.17	ND	30.10	0.30	ND	ND	ND	ND	105.40
0.44	0.10	0.16	0.15	0.05	0.03	ND	35.60	0.20	ND	ND	0.01	ND	119.60

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Lithology	Induration	Moisture	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO
									wt%							
139	856H	04R	3	16	17	29.72	SUL	indurated	ND	3.21	0.01	0.81	68.30	ND	ND	0.02
139	856H	06R	1	39	41	37.79	SUL	indurated	ND	9.60	0.01	0.52	61.90	ND	ND	0.03
139	856H	07R	1	38	40	43.48	SUL	indurated	ND	11.40	0.01	0.10	38.30	ND	ND	0.05
139	856H	07R	1	45	47	43.55	SUL	indurated	ND	11.70	0.01	0.10	65.10	ND	ND	0.01
139	856H	08R	1	28	30	48.28	SUL	indurated	ND	6.89	0.01	0.10	63.60	ND	ND	0.03
139	856H	08R	1	23	25	48.23	SUL	indurated	ND	4.68	0.01	0.10	65.90	ND	ND	0.03
139	856H	08R	1	72	74	48.72	SUL	indurated	ND	3.00	0.01	0.10	53.10	ND	ND	0.01
139	856H	08R	1	118	121	49.18	SUL	indurated	ND	5.81	0.01	0.22	60.20	ND	ND	0.01
139	856H	09R	1	68	70	53.18	SUL	indurated	ND	2.16	0.01	0.10	63.80	ND	ND	0.01
139	856H	09R	1	80	82	53.30	SUL	indurated	ND	0.60	0.01	0.24	64.50	ND	ND	0.01
139	856H	10R	1	20	22	57.20	SUL	indurated	ND	1.06	0.01	0.23	61.30	ND	ND	0.01
139	856H	11R	1	25	27	61.55	SUL	indurated	ND	1.11	0.01	0.10	61.50	ND	ND	0.01
139	856H	11R	1	91	93	62.21	SUL	indurated	ND	0.79	0.01	0.39	64.30	ND	ND	0.01
139	856H	11R	1	108	110	62.38	SUL	indurated	ND	7.10	0.01	0.10	30.70	ND	ND	0.01
139	856H	11R	1	114	117	62.44	SUL	indurated	ND	12.90	0.01	0.10	46.50	ND	ND	0.01
139	856H	13R	1	43	46	71.33	SUL	indurated	ND	19.90	0.01	0.10	49.40	ND	ND	0.02
139	856H	14R	1	16	18	75.86	SUL	indurated	ND	3.17	0.01	0.10	60.40	ND	ND	0.01
139	856H	14R	1	28	30	75.98	SUL	indurated	ND	1.46	0.01	0.10	71.70	ND	ND	0.01
139	856H	14R	1	84	86	76.54	SUL	indurated	ND	0.25	0.01	0.10	76.10	ND	ND	0.01
139	856H	14R	1	108	110	76.78	SUL	indurated	ND	2.99	0.02	0.37	71.30	ND	ND	0.02
139	856H	15R	1	73	76	81.23	SUL	indurated	ND	1.03	0.01	0.10	77.30	ND	ND	0.01
139	856H	15R	1	74	76	81.24	SUL	indurated	ND	1.49	0.01	0.27	72.90	ND	ND	0.02
139	856H	15R	1	118	120	81.68	SUL	indurated	ND	1.24	0.01	0.10	76.10	ND	ND	0.01
139	856H	16R	1	27	29	85.47	SUL	indurated	ND	0.85	0.01	0.10	81.00	ND	ND	0.01
139	856H	16R	1	53	55	85.73	SUL	indurated	ND	1.11	0.01	0.10	70.90	ND	ND	0.01
139	857A	01H	2	80	84	4.20	SUL	non	ND	57.24	0.92	17.01	8.25	ND	ND	0.09
139	857A	01H	2	90	94	4.30	SLCY	non	44.7	54.00	0.82	15.50	6.70	3.10	3.20	0.09
139	857A	01H	4	46	50	6.86	SLCY	non	34.3	55.10	0.97	14.90	7.40	3.70	3.30	0.12
139	857A	01H	6	76	80	10.16	SLCY	non	43.0	50.20	0.72	14.80	7.00	3.00	3.60	0.09
139	857A	02H	1	126	128	12.66	SLCY	non	33.3	57.60	0.89	15.00	7.20	2.60	4.10	0.10
139	857A	02H	2	73	75	13.63	SLCY	non	ND	56.59	0.88	16.36	8.59	ND	ND	0.11
139	857A	02H	3	125	127	15.65	SLCY	non	42.6	49.60	0.71	15.10	7.50	2.70	4.30	0.15
139	857A	02H	5	126	128	18.66	SLCY	non	43.6	53.80	0.81	15.90	8.30	3.70	4.10	0.11
139	857A	02H	7	44	46	20.84	SLCY	non	31.0	56.00	0.81	15.20	6.90	ND	ND	0.11
139	857A	04H	2	67	71	24.07	SLCY	non	30.1	58.50	0.81	14.90	6.50	2.80	3.30	0.07
139	857A	04H	2	86	90	24.26	SLCY	non	ND	56.84	0.84	13.86	11.73	ND	ND	0.08
139	857A	04H	4	25	29	26.65	SLCY	non	36.5	56.50	0.80	15.50	7.00	1.00	5.40	0.08
139	857A	04H	6	25	29	29.65	SILT	non	ND	54.30	0.77	15.60	6.90	3.10	3.40	0.10
139	857A	05H	2	27	31	33.17	SLCY	non	33.9	55.00	0.81	16.90	7.40	ND	ND	0.11
139	857A	05H	3	78	82	35.18	SLCY	non	ND	57.35	0.86	17.37	7.59	ND	ND	0.11
139	857A	05H	4	45	49	36.35	SLCY	non	31.3	58.40	0.77	14.50	8.50	ND	ND	0.08
139	857A	05H	6	54	58	39.44	SLCY	non	36.4	56.80	0.85	15.10	6.90	2.50	4.00	0.11
139	857A	06H	1	143	147	42.33	SLSN	non	28.4	60.70	0.77	14.20	5.50	1.70	3.40	0.08
139	857A	06H	3	52	56	44.42	SLCY	non	35.0	54.10	0.81	15.90	7.70	2.60	4.60	0.11
139	857A	06H	4	54	58	45.94	SLCY	non	ND	58.23	0.90	16.81	7.01	0.00	0.00	0.12
139	857A	06H	5	89	93	47.79	SILT	non	19.7	60.40	0.87	14.20	6.20	2.60	3.20	0.10
139	857A	06H	7	20	24	50.10	SLCY	weak	24.8	59.70	0.84	15.40	6.60	2.90	3.30	0.10
139	857A	07H	2	22	26	50.94	SLSN	non	19.6	65.20	0.85	13.40	5.20	2.00	2.90	0.08
139	857A	07H	3	69	73	52.91	SLCY	non	ND	57.54	0.88	16.00	8.85	ND	ND	0.12
139	857A	07H	3	87	93	53.09	SLCY	indurated	15.4	45.40	0.65	11.90	5.90	2.10	3.40	0.30
139	857A	07H	4	64	68	54.26	SNSL	non	18.6	62.40	0.87	13.70	6.30	2.50	3.40	0.08
139	857A	07H	6	109	113	56.77	SLCY	weak	23.1	56.30	0.86	15.40	7.20	2.40	4.30	0.11
139	857A	08H	2	32	36	61.72	SLCY	weak	34.4	54.60	0.83	15.50	7.80	3.60	3.80	0.11
139	857A	08H	2	95	99	62.35	SLCY	weak	ND	57.14	0.94	15.83	7.87	ND	ND	0.11
139	857A	08H	5	13	17	66.03	SILT	weak	23.1	58.20	0.88	15.10	7.00	2.80	3.80	0.10
139	857A	08H	5	47	51	66.37	SLCY	weak	31.3	54.40	0.87	15.90	7.90	3.10	4.30	0.11
139	857A	08H	7	61	65	68.01	SLCY	weak	24.8	58.10	0.83	14.60	7.10	2.30	4.30	0.10
139	857A	08H	7	3	7	68.93	SLCY	weak	29.5	56.40	0.87	15.80	7.60	2.80	4.30	0.11
139	857A	09H	2	93	98	71.83	SLCY	weak	ND	56.88	0.90	16.04	8.15	ND	ND	0.11
139	857A	09H	3	40	45	72.80	SLCY	weak	27.4	57.00	0.82	15.30	6.80	2.90	3.50	0.11
139	857A	09H	5	105	109	76.45	SNSL	non	17.6	63.20	0.78	14.30	5.40	1.80	3.20	0.07
139	857A	09H	5	53	55	78.00	SLCY	weak	ND	59.30	0.81	15.10	6.40	2.40	3.60	0.09
139	857A	10H	1	95	97	79.85	SLCY	weak	25.3	57.90	0.85	15.30	7.00	2.30	4.20	0.10
139	857A	10H	2	79	81	81.19	SLSN	weak	ND	61.40	0.88	15.43	6.74	ND	ND	0.09
139	857A	10H	4	77	79	84.17	SLSN	non	16.3	64.60	0.75	13.80	4.90	1.70	2.90	0.07
139	857A	10H	6	19	21	86.59	SLSN	non	21.6	62.30	0.82	14.30	5.50	2.10	3.10	0.07
139	857A	11X	CC	26	28	87.33	SLCY	indurated	8.4	25.90	0.38	7.00	6.00	1.20	4.30	0.80
139	857A	13X	1	25	27	101.75	SLCY	moderate	23.8	59.30	0.85	15.30	6.70	2.00	4.20	0.09
139	857A	13X	1	62	63	102.12	SLCY	moderate	27.4	55.10	0.89	15.90	8.20	2.90	4.80	0.11
139	857A	13X	1	91	93	102.41	SLCY	moderate	22.7	57.80	0.88	15.10	7.60	1.80	5.20	0.09
139	857A	13X	1	136	139	102.86	SLCY	moderate	26.7	55.40	0.90	16.40	8.20	2.20	5.40	0.10
139	857A	13X	3	65	67	105.15	SLCY	weak	24.0	56.90	0.87	16.00	7.70	2.10	5.00	0.08
139	857A	13X	3	122	124	105.72	SNSL	weak	ND	59.54	0.90	16.23	7.26	ND	ND	0.08
139	857A	13X	CC	33	35	108.87	SNSL	weak	22.5	58.70	0.85	15.90	6.90	2.00	4.40	0.08
139	857C	02R	1	63	67	57.13	SLCY	weak	ND	57.60	0.93	16.08	7.90	ND	ND	0.10
139	857C	02R	2	6	10	58.06	SLCY	weak	19.1	58.00	0.86	15.50	6.90	3.10	3.40	0.11
139	857C	03R	1	72	74	67.22	SLCY	moderate	32.7	54.20	0.82	15.70	7.70	2.70	4.50	0.10
139	857C	03R	3	38	40	69.88	SLCY	moderate	ND	55.76	0.86	15.93	7.98	ND	ND	0.13
139	857C	03R	3	110	112	70.60	SLCY	moderate	28.0	55.60	0.87	15.60	7.70	2.70	4.50	0.10
139	857C	05R	1	4	8	82.14	SLCY	moderate	ND	57.42	0.86	16.80	7.93	ND	ND	0.10
139	857C	05R	1	12	16	82.22	SLCY	moderate	25.8	57.70	0.81	15.90	7.30	2.60	4.20	0.10
139	857C	05R	4	110	113	84.00	SLCY	moderate	19.4	57.30	0.81	16.70	7.10	2.10	4.50	0.10
139	857C	06R	1	1	2	86.21	SLSN	indurated	0.0	20.80	0.28	5.40	6.20	0.60	5.00	0.93
139	857C	06R	1	33	35	86.53	SLCY									

Table 1 (continued).

MgO	CaO	Na ₂ O	Na ₂ OC	K ₂ O	P ₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC	Na ₂ OX	N	Total
wt%													
2.81	0.21	0.17	0.10	0.05	0.06	ND	33.00	0.70	0.30	0.10	0.07	ND	112.20
3.65	0.14	0.27	ND	0.06	0.04	ND	33.30	0.30	0.10	0.10	ND	ND	111.70
4.12	0.32	0.29	ND	0.09	0.04	ND	30.40	1.80	ND	ND	ND	ND	87.00
2.25	0.37	0.19	0.11	0.03	0.02	ND	33.10	0.60	0.00	0.20	0.08	ND	114.10
3.73	0.44	0.15	ND	0.10	0.04	ND	34.20	0.80	ND	ND	ND	ND	110.30
2.30	0.18	0.15	ND	0.03	0.02	ND	34.20	1.60	0.80	0.20	ND	ND	109.70
1.58	0.05	0.08	ND	0.10	0.05	ND	45.20	0.20	ND	ND	ND	ND	108.10
2.71	0.10	0.16	0.11	0.03	0.01	ND	44.30	0.20	ND	ND	0.05	ND	114.30
1.18	0.12	0.14	0.11	0.03	0.03	ND	47.80	0.30	0.00	0.10	0.03	ND	116.70
0.53	0.10	0.12	ND	0.03	0.02	ND	50.20	0.30	0.00	0.10	ND	ND	117.00
0.90	0.10	0.13	ND	0.03	0.00	ND	48.70	0.40	ND	ND	ND	ND	114.90
1.10	0.10	0.10	ND	0.03	0.04	ND	47.90	1.10	0.00	0.30	ND	ND	113.80
0.50	0.09	0.12	0.08	0.03	0.04	ND	48.60	0.40	0.00	0.10	0.04	ND	115.50
6.77	0.08	0.23	ND	0.10	0.01	ND	41.20	0.30	ND	ND	ND	ND	87.50
8.62	0.19	0.27	0.19	0.05	0.08	ND	34.30	0.20	ND	ND	0.08	ND	104.60
9.80	0.10	0.16	ND	0.12	0.07	ND	30.10	0.10	ND	ND	ND	ND	110.60
2.58	0.09	0.10	ND	0.14	0.04	ND	46.40	0.50	ND	ND	ND	ND	114.40
1.28	0.12	0.15	ND	0.05	0.02	ND	34.10	0.10	ND	ND	ND	ND	111.20
0.38	0.10	0.12	0.04	0.05	0.03	ND	34.70	0.20	ND	ND	0.08	ND	113.30
2.67	1.10	0.14	0.05	0.06	0.07	ND	33.30	0.70	0.10	0.20	0.09	ND	114.00
0.99	0.07	0.10	ND	0.03	0.01	ND	35.40	0.20	ND	ND	ND	ND	118.60
1.40	0.09	0.12	0.05	0.03	0.02	ND	34.50	0.10	ND	ND	0.07	ND	115.20
1.01	0.11	0.11	0.02	0.03	0.03	ND	35.30	0.20	ND	ND	0.09	ND	116.20
0.84	0.12	0.15	0.10	0.03	0.04	ND	35.40	0.50	0.00	0.10	0.05	ND	119.90
0.67	0.15	0.14	0.10	0.05	0.03	ND	35.40	0.50	0.00	0.10	0.04	ND	110.80
3.57	2.86	2.06	ND	2.88	0.21	4.90	0.00	3.52	1.65	0.51	ND	ND	100.53
3.12	5.30	3.30	2.17	2.18	0.20	4.60	0.16	3.90	2.30	0.40	1.13	ND	99.70
3.86	5.81	3.60	2.58	1.82	0.24	3.70	0.14	2.90	2.00	0.20	1.02	ND	100.40
3.53	6.59	3.50	1.61	2.36	0.15	4.70	0.34	6.00	4.00	0.50	1.89	ND	99.80
3.39	4.86	3.60	2.70	1.69	0.20	3.70	0.26	2.40	1.20	0.30	0.90	ND	100.60
4.25	3.23	2.44	ND	2.13	0.19	5.49	0.06	3.63	1.06	0.70	0.00	ND	100.51
3.56	6.94	3.40	2.09	2.47	0.21	4.70	0.80	5.70	3.60	0.60	1.31	ND	100.60
4.02	2.70	3.70	2.19	2.31	0.17	5.40	0.70	2.20	0.00	0.60	1.51	ND	99.80
3.48	4.93	3.60	2.76	1.96	0.21	3.60	0.90	2.20	0.90	0.40	0.84	ND	100.10
3.37	2.61	3.50	ND	2.20	0.17	4.10	0.22	2.80	0.30	0.70	ND	ND	99.60
3.22	2.74	2.03	ND	1.93	0.16	4.27	0.37	3.26	0.59	0.73	ND	ND	99.87
3.30	2.56	3.40	ND	2.36	0.18	5.30	0.67	2.90	0.70	0.60	ND	ND	100.10
3.38	4.69	2.90	ND	2.69	0.21	4.00	0.11	4.10	2.30	0.50	ND	ND	99.50
3.67	3.21	3.20	ND	2.68	0.20	5.10	0.10	2.40	ND	ND	ND	ND	101.00
4.02	2.96	1.97	ND	3.00	0.19	ND	ND	ND	0.92	0.00	ND	ND	99.58
2.97	3.06	3.20	2.32	2.15	0.16	ND	2.49	3.00	0.70	0.60	0.88	ND	99.40
3.32	3.62	3.60	2.43	1.91	0.19	4.00	0.49	3.10	0.80	0.60	1.17	ND	99.70
2.81	4.07	3.50	2.73	1.75	0.19	3.00	0.27	2.10	0.90	0.30	0.77	ND	98.70
3.88	3.91	3.30	2.26	2.33	0.23	4.20	0.46	2.90	1.20	0.50	1.04	ND	99.50
3.64	3.56	2.06	2.06	2.71	0.22	4.36	0.00	2.97	1.61	0.37	0.00	ND	99.16
2.80	5.26	3.60	3.06	1.54	0.21	2.40	0.32	1.90	1.40	0.10	0.54	ND	99.60
3.19	3.94	3.40	2.77	2.02	0.22	2.70	0.16	1.80	0.80	0.30	0.63	ND	99.90
2.21	4.77	3.60	3.13	1.34	0.19	1.70	0.28	1.20	0.70	0.10	0.47	ND	99.90
3.71	3.90	2.31	ND	2.42	0.25	4.54	0.24	3.26	1.83	0.39	ND	0.05	98.39
4.09	13.10	2.40	ND	1.78	0.21	2.40	0.12	11.70	10.70	0.30	ND	ND	99.70
2.50	4.25	3.40	2.91	1.58	0.22	2.60	0.82	1.60	0.90	0.20	0.49	ND	100.10
3.68	4.10	3.40	2.66	1.92	0.23	4.20	0.25	2.40	1.10	0.40	0.74	ND	99.70
4.04	4.90	3.50	ND	1.94	0.22	4.30	0.17	3.40	1.90	0.40	ND	ND	101.00
4.10	4.48	2.75	ND	1.88	0.23	4.27	0.00	3.15	1.47	0.46	ND	ND	99.58
3.48	4.07	3.40	2.67	1.80	0.22	3.30	0.42	2.10	1.00	0.30	0.73	ND	99.80
4.27	3.16	3.30	2.40	2.25	0.21	5.20	0.24	2.30	0.80	0.40	0.90	ND	99.80
3.40	4.25	3.40	2.71	1.83	0.20	3.10	0.56	2.20	1.20	0.30	0.69	ND	99.30
4.02	3.29	3.20	2.24	2.10	0.22	4.80	0.37	2.40	1.00	0.40	0.96	ND	100.90
4.46	3.35	2.15	ND	2.53	0.23	5.17	0.00	2.97	1.17	0.49	ND	ND	99.55
3.62	4.25	3.30	2.55	2.17	0.23	4.20	0.14	2.70	1.60	0.30	0.75	ND	100.40
2.46	4.40	3.50	3.04	1.61	0.19	2.10	0.28	1.80	1.10	0.20	0.46	ND	99.90
3.27	4.12	3.60	2.94	1.89	0.22	3.00	0.15	1.80	0.90	0.20	0.66	ND	99.50
3.66	3.59	3.40	2.69	2.12	0.24	3.70	0.28	2.20	1.20	0.30	0.71	ND	100.00
3.36	3.70	2.60	ND	1.92	0.22	3.54	0.26	2.75	1.10	0.45	ND	ND	99.07
2.36	4.05	3.60	3.13	1.58	0.18	2.00	0.15	1.50	0.80	0.20	0.47	ND	99.40
2.62	4.06	3.60	2.98	1.76	0.20	2.00	0.29	1.70	0.90	0.20	0.62	ND	99.00
10.20	19.80	1.40	ND	1.05	0.23	2.10	0.63	26.20	26.00	0.10	ND	ND	101.30
3.71	3.73	3.60	3.02	1.75	0.20	3.20	0.17	1.70	0.70	0.30	0.58	ND	100.00
4.62	3.45	3.50	3.50	1.94	0.22	3.80	0.08	2.00	0.80	0.30	0.00	ND	99.40
3.76	3.49	3.50	2.83	1.71	0.19	3.50	0.76	1.50	0.50	0.30	0.67	ND	99.40
4.70	3.04	3.30	2.53	2.11	0.21	3.60	0.23	2.10	0.60	0.40	0.77	ND	99.80
4.11	2.68	3.40	2.44	2.09	0.18	3.70	0.40	1.80	0.00	0.50	0.96	ND	99.50
4.08	2.91	2.58	ND	2.19	0.19	3.90	0.78	3.74	1.06	0.73	ND	ND	100.01
3.55	2.35	3.40	2.87	1.88	0.19	4.10	0.27	1.30	0.00	0.40	0.53	ND	99.10
4.55	3.74	2.61	ND	2.03	0.22	3.90	0.43	3.15	1.50	0.45	ND	0.34	99.86
3.69	3.79	3.30	2.65	2.21	0.25	3.00	0.09	2.20	1.30	0.20	0.65	ND	99.70
4.28	3.48	3.40	2.54	2.27	0.20	3.90	0.15	2.80	1.10	0.50	0.86	ND	98.70
4.48	4.40	2.18	ND	2.53	0.24	4.09	0.02	2.42	1.10	0.36	ND	0.13	100.16
4.30	3.38	3.40	2.69	2.02	0.19	3.50	0.09	2.30	0.80	0.40	0.71	ND	98.70
4.98	2.43	2.54	ND	2.16	0.23	3.09	0.00	18.28	16.89	0.38	ND	0.06	100.43
4.09	2.87	3.40	2.81	1.91	0.23	4.10	0.12	1.80	0.20	0.40	0.59	ND	100.00
3.79	3.84	4.20	3.74	1.64	0.24	2.60	0.21	1.10	0.40	0.20	0.46	ND	99.30
11.90	21.20	1.20	ND	0.55	0.19	1.50	0.07	30.50	30.30	0.10	ND	ND	100.20
4.58	2.18	2.45	ND	2.26	0.19	4.99	0.03	1.76	0.26	0.41	ND	0.07	99.83
5.08	2.01	3.08	ND	2.33	0.19	5.17	0.00	1.80	0.26	0.42	ND	0.07	101.61
4.35	2.53	3.40	2.63	2.07	0.19	4.30	0.16	1.80	0.20	0.40	0.77	ND	99.80
11.50	19.50	1.60	ND	0.60	0.19	1.30	0.15	27.00	26.90	0.00	ND	ND	99.50
10.10	18.00	1.60	1.48	0.78	0.31	1.80	0.14	24.60	20.00	1.30	0.12	ND	100.00

Table 1 (continued).

Leg	Hole	Core	Section	Udepth	Ldepth	Depth	Lithology	Induration	Moisture	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO
				(cm)	(cm)	(mbsf)										
139	857C	09R	1	8	9	114.58	SLST	indurated	3.7	22.90	0.34	7.00	3.70	0.80	2.60	1.97
139	857C	09R	1	27	30	114.77	SLCY	indurated	ND	58.17	0.93	16.63	7.67	ND	ND	0.10
139	857C	09R	1	89	91	115.39	SILT	moderate	20.6	61.10	0.86	15.20	6.70	1.70	4.50	0.09
139	857C	10R	1	65	67	124.75	SLCY	moderate	32.0	54.80	0.78	16.90	7.80	2.80	4.50	0.10
139	857C	11R	1	124	126	135.04	SILT	indurated	ND	61.97	0.88	15.15	7.88	ND	ND	0.08
139	857C	12R	1	9	10	143.59	SILT	indurated	1.9	38.00	0.47	8.90	3.40	ND	ND	0.76
139	857C	12R	1	40	43	143.90	SILT	moderate	17.6	62.70	0.72	14.90	5.40	1.50	3.50	0.08
139	857C	12R	1	47	48	143.97	SILT	indurated	0.0	43.30	0.39	9.10	7.90	ND	ND	0.46
139	857C	12R	1	80	83	144.30	SLCY	indurated	ND	56.79	0.96	17.17	8.74	ND	ND	0.10
139	857C	12R	1	126	127	144.76	SLST	indurated	10.0	30.70	0.48	9.00	4.50	ND	ND	0.70
139	857C	13R	1	6	8	153.16	SLST	indurated	9.0	54.80	0.66	13.80	5.00	1.80	2.90	0.26
139	857C	13R	1	52	55	153.62	SLCY	moderate	6.1	59.60	0.83	15.60	6.80	2.00	4.30	0.09
139	857C	13R	2	48	51	155.08	SLCY	moderate	ND	55.57	0.96	17.24	9.19	ND	ND	0.11
139	857C	13R	3	52	54	156.62	SILT	moderate	20.7	62.00	0.77	14.70	5.80	1.90	3.50	0.08
139	857C	14R	2	27	31	164.57	SLCY	moderate	ND	59.10	0.89	16.02	7.53	ND	ND	0.11
139	857C	14R	2	50	54	164.80	SLCY	moderate	19.5	59.30	0.81	15.40	6.40	2.00	4.00	0.09
139	857C	15R	1	93	95	173.43	SLCY	moderate	ND	58.75	0.96	16.99	7.41	ND	ND	0.11
139	857C	15R	1	147	149	173.97	SLCY	moderate	18.6	52.00	0.69	13.60	5.20	1.60	3.20	0.24
139	857C	15R	3	142	144	176.92	SLCY	moderate	24.1	53.90	0.92	16.90	8.70	2.10	5.90	0.12
139	857C	16R	1	15	17	182.35	SILT	moderate	ND	62.39	0.92	14.89	6.40	ND	ND	0.11
139	857C	17R	1	82	86	192.72	SILT	moderate	ND	60.30	0.89	14.26	7.33	ND	ND	0.12
139	857C	17R	2	61	65	194.01	SLCY	moderate	22.0	54.80	0.85	16.40	8.30	2.30	5.40	0.11
139	857C	18R	1	76	80	202.36	SLCY	moderate	ND	56.82	0.93	17.27	8.75	ND	ND	0.12
139	857C	18R	2	30	34	203.40	SLCY	moderate	18.9	57.70	0.88	16.50	7.80	1.60	5.60	0.10
139	857C	19R	2	57	61	213.37	SLCY	moderate	ND	55.30	0.91	16.80	8.60	1.90	6.00	0.12
139	857C	19R	2	78	82	213.58	SILT	indurated	ND	60.39	0.90	15.87	7.25	ND	ND	0.11
139	857C	21R	1	24	26	230.84	SLCS	indurated	12.9	61.30	0.81	15.30	6.30	1.40	4.40	0.08
139	857C	21R	1	129	131	231.89	SILT	indurated	ND	61.41	0.87	15.87	6.71	ND	ND	0.09
139	857C	21R	3	27	29	233.87	SLCS	indurated	16.1	60.20	0.80	16.00	7.00	1.40	5.00	0.09
139	857C	22R	1	28	32	240.58	SLCS	indurated	15.0	58.30	0.84	16.40	7.40	1.20	5.60	0.10
139	857C	22R	1	124	127	241.54	SLCY	indurated	ND	59.26	0.91	16.55	7.59	ND	ND	0.11
139	857C	22R	0	1	5	242.01	SLCS	indurated	6.0	29.40	0.49	9.00	4.30	0.60	3.30	0.59
139	857C	24R	1	31	35	259.51	SLCS	indurated	11.4	45.00	0.71	13.90	6.60	0.60	5.40	0.26
139	857C	24R	1	57	59	259.77	SLCY	indurated	15.5	54.20	0.90	17.60	9.20	1.10	7.30	0.11
139	857C	24R	2	5	7	260.75	SLCY	indurated	17.7	55.70	0.90	17.70	8.80	1.20	6.80	0.11
139	857C	24R	2	33	37	261.03	SLCY	indurated	ND	56.54	0.96	17.40	8.65	ND	ND	0.11
139	857C	25R	1	6	8	268.86	SLCS	indurated	17.0	54.90	0.88	17.80	8.60	1.00	6.80	0.11
139	857C	25R	1	51	54	269.31	SLCY	indurated	ND	56.38	0.94	17.88	8.77	ND	ND	0.11
139	857C	26R	1	18	20	274.68	SLCS	indurated	14.9	55.40	0.91	17.50	8.90	1.00	7.10	0.12
139	857C	26R	1	66	68	275.16	SLCY	indurated	ND	56.30	0.97	17.21	8.65	ND	ND	0.11
139	857C	26R	0	1	3	276.24	SNST	indurated	3.9	53.10	0.61	11.30	3.90	0.90	2.70	0.24
139	857C	27R	1	116	120	285.26	SLCS	indurated	17.4	55.30	0.91	17.70	8.80	1.20	6.80	0.12
139	857C	27R	2	87	90	286.47	SLCY	indurated	ND	54.54	0.97	17.98	9.32	ND	ND	0.12
139	857C	28R	2	119	122	296.49	SLCS	indurated	17.0	55.30	0.93	17.10	8.70	1.00	6.90	0.11
139	857C	28R	3	27	29	297.07	SLCY	indurated	ND	55.90	0.96	17.07	8.56	ND	ND	0.12
139	857C	29R	1	58	61	303.98	SILT	indurated	ND	60.36	0.94	15.95	7.32	ND	ND	0.10
139	857C	28R	CC	1	4	313.00	SNST	indurated	2.3	38.30	0.46	8.60	3.00	0.20	2.60	0.24
139	857C	30R	1	116	120	314.26	SSSL	indurated	14.9	61.90	0.80	14.70	5.90	0.50	4.90	0.08
139	857C	30R	2	74	77	315.34	SILT	indurated	ND	60.94	0.90	15.75	7.08	ND	ND	0.11
139	857C	30R	3	30	33	316.40	SLCS	indurated	8.3	54.40	0.88	17.10	8.20	0.90	6.60	0.11
139	857C	31R	1	121	123	323.91	SLCS	indurated	12.9	55.60	0.89	17.70	8.90	1.00	7.10	0.12
139	857C	31R	2	15	17	324.35	SLCS	indurated	13.8	55.00	0.89	17.60	8.70	0.90	7.00	0.12
139	857C	31R	2	102	105	325.22	SLCS	indurated	ND	56.01	0.93	17.46	8.55	ND	ND	0.11
139	857C	32R	1	34	37	327.94	SLCS	indurated	13.0	57.80	0.85	16.60	7.80	1.20	5.90	0.11
139	857C	33R	1	56	59	332.96	SLCS	indurated	13.2	57.30	0.88	17.00	8.20	1.10	6.40	0.11
139	857C	33R	2	71	73	334.61	SLCS	indurated	ND	55.71	0.96	17.69	9.08	ND	ND	0.13
139	857C	33R	3	65	68	336.05	SLCS	indurated	11.3	57.10	0.84	17.50	8.00	1.00	6.30	0.11
139	857C	34R	1	120	122	337.70	SLST	indurated	11.0	58.20	0.79	15.40	7.50	ND	ND	0.09
139	857C	34R	3	44	47	339.94	SLCS	indurated	14.1	58.40	0.81	16.60	7.50	0.20	6.70	0.13
139	857C	35R	1	34	36	341.64	SLST	indurated	12.5	57.80	0.92	16.50	7.90	ND	ND	0.11
139	857C	35R	1	124	127	342.54	SLST	indurated	ND	63.11	0.91	15.21	6.57	ND	ND	0.10
139	857C	35R	5	31	33	344.50	SLCS	indurated	13.6	52.50	0.90	18.50	9.70	0.80	8.00	0.12
139	857C	36R	1	29	32	346.39	SLCS	indurated	12.9	51.70	0.84	17.20	9.10	1.00	7.30	0.14
139	857C	36R	1	79	81	348.89	SLCS	indurated	3.7	54.30	0.89	18.20	9.40	1.10	7.50	0.11
139	857C	36R	3	58	61	349.68	SLCS	indurated	11.4	56.10	0.94	17.00	8.70	1.30	6.70	0.11
139	857C	37R	1	115	119	351.95	SLCS	indurated	11.8	55.70	0.93	16.80	9.20	1.10	7.30	0.11
139	857C	37R	2	115	119	353.45	SLCS	indurated	ND	57.38	0.90	16.74	9.01	ND	ND	0.11
139																

Table 1 (continued).

MgO	CaO	Na ₂ O	Na ₂ OC	K ₂ O	P ₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC	Na ₂ OX	N	Total
wt%													
3.28	30.80	1.30	1.21	0.88	0.54	2.30	0.09	25.50	ND	ND	0.09	ND	100.40
4.61	2.40	2.72	ND	2.49	0.18	4.36	0.04	2.05	0.37	0.46	ND	0.09	100.09
3.63	3.32	3.50	ND	1.73	0.25	3.30	0.30	2.00	0.80	0.30	ND	ND	101.60
4.55	2.69	2.80	1.91	2.71	0.20	5.50	0.37	2.70	1.00	0.50	0.89	ND	101.60
3.30	3.24	2.86	ND	1.73	0.20	2.36	1.27	1.65	0.66	0.27	ND	0.06	99.35
1.78	23.50	2.10	ND	0.86	0.15	1.70	0.16	18.00	ND	ND	ND	ND	99.90
2.54	3.42	3.60	3.17	1.59	0.18	2.90	0.40	1.50	0.70	0.20	0.43	ND	99.70
1.14	16.80	2.40	2.25	0.88	0.10	ND	4.84	12.40	12.00	0.10	0.15	ND	99.80
5.16	2.14	2.17	ND	2.24	0.23	5.36	0.20	2.09	0.33	0.48	ND	0.06	100.49
2.53	25.60	1.70	ND	1.08	0.19	2.80	0.33	19.90	ND	ND	ND	ND	99.60
2.59	10.20	3.40	ND	1.18	0.20	2.20	0.14	6.20	5.60	0.20	ND	ND	100.40
3.46	3.29	3.60	3.10	1.76	0.22	2.90	0.31	1.50	0.40	0.30	0.50	ND	99.60
5.41	2.03	2.33	ND	2.26	0.23	5.27	0.12	1.72	0.11	0.44	ND	0.07	100.37
2.81	3.87	3.70	3.30	1.48	0.19	2.40	0.16	1.60	0.80	0.20	0.40	ND	99.30
4.35	3.48	3.14	ND	1.70	0.22	2.91	0.05	1.47	0.66	0.22	ND	0.05	99.86
3.37	4.11	3.90	3.52	1.51	0.21	2.60	0.21	1.60	0.70	0.20	0.38	ND	99.20
4.32	2.60	3.14	ND	2.09	0.23	4.09	0.00	0.95	0.00	0.26	ND	0.02	99.15
2.26	10.70	3.60	3.29	1.42	0.19	2.20	0.35	6.80	6.20	0.20	0.31	ND	99.00
5.27	2.99	3.90	3.35	1.98	0.24	4.20	0.14	1.50	0.30	0.30	0.55	ND	100.30
3.17	4.19	3.22	ND	1.43	0.22	2.63	0.22	1.83	1.21	0.17	ND	0.02	100.32
6.76	0.72	2.86	ND	0.20	0.21	3.45	0.00	8.66	7.19	0.40	ND	0.03	100.08
4.97	2.94	4.00	3.47	1.81	0.23	4.00	0.29	1.20	0.20	0.30	0.53	ND	99.50
5.04	1.89	3.26	ND	2.17	0.19	4.63	0.20	1.47	0.26	0.33	ND	0.04	99.78
4.20	2.33	3.90	3.52	1.97	0.23	3.60	0.16	1.30	0.10	0.30	0.38	ND	100.20
4.77	2.38	4.40	4.01	1.79	0.21	4.10	0.19	1.20	0.00	0.30	0.39	ND	100.20
3.93	2.55	3.47	ND	1.89	0.20	3.18	0.21	1.58	0.77	0.22	ND	0.02	99.57
3.24	2.45	4.30	4.18	1.66	0.23	3.10	0.15	1.10	0.00	0.30	0.12	ND	99.70
3.42	2.38	4.44	ND	1.75	0.22	2.81	0.30	1.17	0.26	0.25	ND	0.03	100.66
3.53	2.33	4.30	4.02	1.74	0.22	3.10	0.13	1.30	0.10	0.30	0.28	ND	100.30
3.61	2.21	4.40	ND	1.78	0.25	3.40	0.26	1.30	0.10	0.30	ND	ND	99.80
3.88	2.29	4.20	ND	1.76	0.22	3.36	0.25	1.32	0.26	0.29	ND	0.04	101.17
2.08	27.20	2.20	ND	1.05	0.15	2.40	0.10	21.60	21.20	0.10	ND	ND	100.30
3.17	12.30	3.30	ND	1.57	0.27	3.50	0.17	9.90	8.60	0.40	ND	ND	100.20
4.39	1.80	4.00	3.70	1.97	0.22	4.80	0.34	1.80	0.10	0.50	0.30	ND	100.70
4.24	1.90	4.10	3.79	1.94	0.22	4.10	0.20	1.70	0.00	0.50	0.31	ND	101.00
4.36	1.92	3.95	ND	2.18	0.22	3.81	0.35	1.76	0.18	0.43	ND	0.05	100.39
4.20	1.70	4.00	3.76	2.10	0.22	4.20	0.20	1.80	0.00	0.50	0.24	ND	100.10
4.36	1.73	3.73	ND	1.92	0.21	3.54	0.31	1.98	0.22	0.48	ND	0.05	100.28
4.48	2.04	4.30	4.04	1.82	0.23	4.20	0.16	1.60	0.10	0.40	0.26	ND	101.00
4.56	2.11	4.20	ND	1.76	0.22	3.54	0.07	1.69	0.51	0.32	ND	0.06	100.79
1.73	12.70	3.90	3.81	1.06	0.15	1.50	0.10	9.10	8.70	0.10	0.09	ND	99.20
4.38	1.86	4.10	3.86	1.94	0.23	4.10	0.16	1.40	0.20	0.30	0.24	ND	100.40
4.97	1.86	3.67	ND	1.98	0.22	4.54	0.37	1.80	0.26	0.42	ND	0.06	100.67
4.41	2.20	4.30	4.04	1.75	0.23	3.90	0.17	1.60	0.20	0.40	0.26	ND	100.10
4.68	2.55	4.06	ND	1.70	0.22	3.81	0.22	2.05	0.73	0.36	ND	0.04	99.76
3.80	2.28	4.28	ND	1.51	0.21	3.27	0.24	1.36	0.44	0.25	ND	0.05	100.88
1.53	ND	2.70	2.65	0.81	0.14	1.40	0.11	18.30	18.30	0.00	0.05	ND	99.50
2.99	2.59	4.40	4.18	1.55	0.22	2.80	0.30	1.50	0.80	0.20	0.22	ND	99.30
3.74	2.27	3.91	ND	1.72	0.26	0.00	ND	0.51	0.51	ND	ND	ND	100.62
3.93	2.66	3.80	3.58	2.04	0.22	4.10	0.16	2.30	0.80	0.40	0.22	ND	99.30
4.39	1.89	3.90	3.70	2.13	0.23	4.30	0.19	1.70	0.10	0.40	0.20	ND	101.30
4.34	1.95	3.90	3.66	2.08	0.22	4.40	0.16	1.60	0.10	0.40	0.24	ND	100.30
4.48	2.23	3.59	ND	2.05	0.23	3.81	0.24	1.94	0.51	0.39	ND	0.04	100.66
3.88	2.01	4.30	4.10	1.78	0.22	3.70	0.13	1.40	0.20	0.30	0.20	ND	100.10
4.09	1.88	4.30	4.10	1.88	0.21	3.90	0.09	1.40	0.10	0.40	0.20	ND	100.70
4.98	1.74	3.74	ND	2.01	0.21	4.27	0.24	1.39	0.15	0.34	ND	0.05	99.95
4.20	1.85	4.20	ND	1.97	0.22	4.10	0.10	1.40	ND	ND	ND	ND	101.00
2.87	3.34	2.80	2.64	2.31	0.20	ND	1.30	3.00	1.30	0.50	0.16	ND	97.90
3.43	1.58	3.20	2.96	2.31	0.16	4.20	0.26	2.40	0.00	0.70	0.24	ND	100.40
3.63	1.85	3.20	2.97	1.18	0.20	4.00	0.58	2.50	0.20	0.60	0.23	ND	101.50
3.13	2.20	3.35	ND	1.85	0.19	3.18	0.45	2.01	0.66	0.37	ND	0.05	99.98
5.11	1.54	2.50	2.30	2.66	0.28	5.30	0.11	1.70	0.00	0.50	0.20	ND	100.20
4.45	3.97	2.50	2.28	2.62	0.29	4.50	0.08	3.30	2.00	0.40	0.22	ND	100.00
4.49	1.55	2.70	2.50	2.79	0.30	4.90	0.21	1.10	0.00	0.30	0.20	ND	100.30
4.33	2.18	3.20	3.00	2.18	0.25	4.30	0.09	1.40	0.40	0.30	0.20	ND	100.20
4.72	2.14	3.20	3.00	1.98	0.23	4.40	0.13	1.40	0.40	0.30	0.20	ND	100.30
4.34	2.30	3.13	ND	2.17	0.22	3.99	1.03	1.94	0.88	0.29	ND	0.06	99.74
3.28	2.90	3.50	3.30	1.89	0.20	ND	1.13	2.10	1.00	0.30	0.20	ND	98.70
3.42	7.47	3.70	3.54	1.79	0.22	3.10	0.28	5.40	4.50	0.20	0.16	ND	99.80
2.91	2.11	4.40	4.24	1.68	0.19	2.70	0.25	1.00	0.30	0.20	0.16	ND	100.40
4.57	2.30	3.70	3.51	2.05	0.21	4.00	0.19	1.60	0.40	0.30	0.19	ND	100.60
4.46	2.58	3.21	ND	1.86	0.21	3.72	0.28	1.87	0.77	0.30	ND	0.03	101.07
3.68	3.41	3.40	3.18	2.07	0.19	3.50	0.28	2.80	1.40	0.40	0.22	ND	100.30
4.30	2.45	3.60	3.38	2.23	0.23	4.20	0.37	2.10	0.60	0.40	0.22	ND	100.70
5.10	2.44	2.66	ND	2.48	0.21	4.63	0.29	2.56	0.73	0.50	ND	0.07	100.43
3.13	2.71	3.90	3.70	1.78	0.21	2.80	0.35	1.70	0.70	0.30	0.20	ND	99.70
3.87	2.42	3.60	3.29	1.92	0.21	3.90	0.24	1.50	0.40	0.30	0.31	ND	100.00
3.73	2.49	3.60	3.42	2.00	0.21	3.60	0.21	1.70	0.40	0.40	0.18	ND	100.50
4.29	2.40	2.90	2.67	2.29	0.22	4.30	0.32	2.10	0.00	0.60	0.23	ND	100.90
4.54	2.35	2.57	ND	2.38	0.21	4.54	0.34	2.27	0.62	0.45	ND	0.07	100.44
3.92	2.08	3.20	ND	2.17	0.21	4.30	0.36	1.70	0.20	0.40	ND	ND	99.70
3.38	3.07	3.60	ND	1.80	0.23	3.40	0.34	1.90	0.90	0.30	ND	ND	99.70
4.73	2.48	3.10	ND	2.20	0.22	4.90	0.19	2.10	ND	ND	ND	ND	101.80
3.01	3.25	4.00	3.82	1.40	0.19	2.90	0.44	1.80	1.00	0.20	0.18	ND	99.80
5.38	2.20	2.92	ND	2.23	0.21	4.36	0.22	1.72	0.51	0.33	ND	0.04	100.64
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4.15	2.77	3.50	3.30	1.93	0.20	4.00	0.22	1.70	0.70	0.30	0.20	ND	100.50
4.89	2.34	3.00	2.85	2.36	0.22	4.50	0.17	1.70	0.30	0.40	0.15	ND	100.80

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Lithology	Induration	Moisture	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO
									wt%							
139	857C	47R	1	56	59	404.56	SLCS	indurated	8.2	55.10	0.93	17.00	8.60	0.60	7.20	0.11
139	857C	47R	2	5	8	405.55	SLCS	indurated	ND	56.23	0.94	17.35	8.52	ND	ND	0.11
139	857C	48R	1	68	70	409.38	SLCS	indurated	9.0	54.10	0.89	17.40	8.80	0.20	7.80	0.11
139	857C	49R	2	45	47	415.65	SNST	indurated	7.4	65.58	0.54	14.71	3.56	ND	ND	0.07
139	857C	49R	2	74	77	415.94	SLCS	indurated	ND	55.10	0.91	17.20	8.90	0.90	7.20	0.12
139	857C	50R	2	42	44	420.22	SLST	indurated	5.6	56.00	0.91	17.50	8.60	0.60	7.20	0.11
139	857C	51R	1	28	30	423.68	SLCS	indurated	ND	56.38	0.99	16.90	9.23	ND	ND	0.12
139	857C	51R	2	12	15	425.02	SSST	indurated	9.9	62.70	0.75	14.60	5.60	0.50	4.60	0.08
139	857C	53R	1	24	26	433.04	SLCS	indurated	ND	55.92	0.97	17.61	9.03	ND	ND	0.11
139	857C	53R	1	50	52	433.30	SLCS	indurated	9.1	57.20	0.90	17.00	8.10	0.30	7.00	0.11
139	857C	55R	1	17	20	442.17	SLCS	indurated	8.5	59.80	0.84	15.90	7.00	0.30	6.00	0.10
139	857C	55R	1	24	26	442.24	SLST	indurated	0.0	62.40	0.79	15.00	5.80	0.20	5.10	0.09
139	857C	55R	1	25	27	442.25	SNST	indurated	ND	55.26	0.78	13.29	5.31	ND	ND	0.17
139	857C	58R	1	16	17	461.66	SLCS	indurated	6.7	56.00	0.95	17.10	8.30	0.70	6.80	0.13
139	857C	61R	1	96	97	491.46	SLST	indurated	1.8	55.40	0.93	16.70	8.30	0.20	7.30	0.14
139	857C	61R	1	113	115	491.63	SLST	indurated	ND	62.49	0.76	14.31	7.64	ND	ND	0.13
139	857C	61R	1	129	131	491.79	SNST	indurated	0.0	64.10	0.65	13.90	4.70	ND	ND	0.12
139	857C	63R	1	13	16	509.83	SLCS	indurated	ND	59.46	0.90	15.86	7.53	ND	ND	0.17
139	857C	65R	1	15	17	529.25	SNST	indurated	ND	63.15	0.85	14.84	6.22	ND	ND	0.09
139	857C	66R	1	15	17	538.95	SNST	indurated	ND	61.46	0.87	14.73	7.02	ND	ND	0.14
139	857C	66R	1	21	23	539.01	SLCS	indurated	1.6	51.00	1.69	16.20	10.70	ND	ND	0.24
139	857C	66R	1	89	91	539.69	SLCS	indurated	0.0	41.20	2.06	17.50	13.10	ND	ND	0.32
139	857C	67R	1	7	9	548.47	SNST	indurated	0.0	71.10	0.59	11.90	4.10	1.30	2.50	0.09
139	857C	67R	1	55	57	548.95	SNST	indurated	ND	72.48	0.62	10.11	5.21	ND	ND	0.13
139	857D	01R	1	128	130	582.78	SNST	indurated	ND	71.72	0.47	9.12	7.31	ND	ND	0.14
139	857D	01R	1	137	139	582.87	SNST	indurated	1.9	71.50	0.44	9.20	7.20	ND	ND	0.14
139	857D	01R	2	36	38	583.36	SLCS	indurated	1.6	67.00	0.55	10.90	8.30	ND	ND	0.18
139	857D	04R	2	75	77	611.15	SLST	indurated	0.0	59.20	0.86	14.20	9.00	1.70	6.60	0.17
139	857D	05R	1	26	28	618.86	SLCS	indurated	1.2	59.70	0.67	13.00	10.30	ND	ND	0.13
139	857D	06R	1	20	22	628.10	SLST	indurated	1.5	68.30	0.56	8.80	11.50	ND	ND	0.13
139	857D	11R	1	1	3	676.21	SNST	indurated	0.0	70.70	0.49	11.00	5.30	ND	ND	0.12
139	857D	14R	1	22	25	705.00	SLCS	indurated	0.0	60.70	0.85	16.10	6.60	2.50	3.70	0.13
139	857D	15R	1	74	76	715.54	SLCS	indurated	0.0	58.90	0.80	15.50	7.50	ND	ND	0.15
139	857D	16R	1	53	55	725.03	SLCS	indurated	0.0	58.90	0.84	15.30	7.20	ND	ND	0.16
139	857D	17R	1	34	36	734.24	SNST	indurated	6.7	63.00	0.57	13.90	7.70	ND	ND	0.09
139	857D	17R	1	146	148	735.36	SLCS	indurated	10.7	58.80	0.89	17.00	7.40	0.80	5.90	0.14
139	857D	17R	2	10	13	735.50	SLST	indurated	5.1	59.90	0.86	15.60	7.00	0.70	5.70	0.12
139	857D	17R	2	53	55	735.93	SNST	indurated	5.0	66.10	0.51	12.20	7.50	ND	ND	0.09
139	857D	17R	3	23	25	737.07	SNST	indurated	ND	71.20	0.42	11.20	4.30	2.90	1.30	0.15
139	857D	21R	1	140	143	773.60	SLCS	indurated	7.8	62.10	0.79	15.30	6.60	2.30	3.90	0.14
139	857D	21R	2	14	16	773.84	SNST	indurated	5.9	65.50	0.67	13.90	5.40	1.50	3.50	0.13
139	857D	24R	1	40	42	801.60	SNST	indurated	4.3	64.70	0.69	13.90	5.30	2.20	2.80	0.10
139	857D	28R	1	67	69	839.57	SNST	indurated	1.7	63.90	0.69	13.40	6.30	ND	ND	0.15
139	857D	29R	1	11	12	848.51	SNST	indurated	3.4	65.00	0.71	12.90	6.00	2.80	2.90	0.13
139	857D	30R	1	23	25	859.13	SLCS	indurated	8.1	59.60	0.88	15.70	6.90	1.90	4.50	0.14
139	857D	31R	1	35	37	868.85	SLST	indurated	3.2	67.00	0.65	13.20	5.30	ND	ND	0.10
139	857D	34R	1	87	89	898.37	SNST	indurated	4.7	59.40	0.82	15.80	6.80	2.70	3.70	0.14
139	857D	37R	1	21	23	926.71	SNST	indurated	ND	63.92	0.67	14.96	6.81	ND	ND	0.11
139	857D	37R	1	38	40	926.88	STSS	indurated	5.0	62.70	0.59	15.20	5.60	3.50	1.90	0.11
139	858A	01H	1	76	78	0.76	SLSC	weak	1.9	50.00	0.81	14.60	6.90	ND	ND	0.10
139	858A	01H	1	81	83	0.81	SLST	non	ND	60.61	0.94	16.77	7.99	ND	ND	0.12
139	858A	01H	2	5	7	1.55	SLCY	non	43.6	54.40	0.96	15.80	7.60	4.80	2.50	0.08
139	858A	01H	2	32	34	1.82	SILT	weak	0.0	54.30	0.85	16.10	7.90	3.50	4.00	0.09
139	858A	02H	1	34	36	2.74	SILT	non	ND	63.81	1.02	14.39	5.99	ND	ND	0.16
139	858A	02H	1	125	127	3.65	SLCY	non	38.4	54.60	0.81	16.20	7.60	3.60	3.60	0.11
139	858A	02H	3	27	31	5.67	SLCY	non	41.9	48.50	0.68	13.90	6.70	2.50	3.80	0.09
139	858A	02H	3	49	52	5.89	SILT	weak	1.9	49.60	0.67	14.60	6.70	ND	ND	0.09
139	858A	02H	3	89	93	6.29	SLCY	non	47.3	49.10	0.67	14.00	6.50	2.30	3.80	0.09
139	858A	02H	3	127	129	6.67	SLCY	non	34.3	55.20	0.77	17.00	7.40	3.20	3.80	0.12
139	858A	02H	5	40	44	8.80	SLCY	non	ND	53.50	0.81	15.50	8.40	ND	ND	0.12
139	858A	02H	5	59	63	8.99	SLCY	non	39.8	51.80	0.80	15.50	7.40	3.40	3.60	0.12
139	858A	02H	5	80	81	9.20	SLCY	non	35.4	56.00	0.75	16.80	7.40	3.00	4.00	0.09
139	858A	02H	5	93	96	9.33	SILT	weak	1.7	53.60	0.84	16.10	7.80	2.70	4.60	0.12
139	858A	02H	6	99	100	10.89	SILT	non	0.0	26.50	0.36	7.40	3.10	ND	ND	0.16
139	858A	02H	7	30	31	11.70	SILT	non	2.0	15.70	0.22	4.60	1.90	ND	ND	0.18
139	858A	02H	7	59	61	11.97	SLCY	non	33.0	55.80	0.80	16.10	7.10	2.40	4.20	0.10
139	858A	02H	CC	113	114	12.00	SILT	non	5.6	27.30	0.36	7.80	3.30	ND	ND	0.29
139	858A	03H	1	108	110	12.98	SLCY	non	25.4	38.30	0.58	11.10	5.60	ND	ND	0.16
139	858A	03H	2	44	48	13.61	SLCY	non	39.3	52.30	0.70	15.50	6.90	ND	ND	0.12
139	858A	03H	3	81	85	15.48	SILT	weak	ND	61.54	0.85	17.44	7.33	ND	ND	0.10
139	858A	03H	3	85	87	15.52	SILT	weak	0.0	57.90	0.76	16.90	6.80	2.40	4.00	0.08
139	858A	03H	4	29	33	16.46	SLCY	non	32.3	57.90	0.74	16.10	6.60	2.30	3.90	0.08
139	858A	03H	6	43	47	19.60	SLCY	non	35.8	58.90	0.80	15.10	6.70	2.70	3.60	0.07
139	858A	03H	6	50	51	19.67	SLCY	weak	ND	ND	0.61	10.80	4.54	ND	ND	1.55
139	858A	03H	6	87	90	20.04	SILT	weak	1.7	59.00	0.83	15.60	6.80	2.60	3.80	0.07
139	858A	03H	CC	1	3	21.33	SLCY	weak	1.8	57.10	0.79	14.10	5.80	ND	ND	0.11
139	858A	04H	2	66	70	23.56	SLCY	non	30.2	57.00	0.76	16.20	6.40	1.70	4.20	0.09
139	858A	04H	2	76	80	23.66	SILT	moderate	1.4	55.70	0.75	16.20	8.20	ND	ND	0.09
139	858A	04H	2	79	83	23.69	SILT	non	ND	62.67	0.89	17.59	6.94	ND	ND	0.09
139	858A	04H	2	96	100	23.86	SSSL	non	25.2	60.30	0.72	13.70	5.20	1.40	3.40	0.09
139	858A	04H	4	46	50	26.36	SILT	moderate	0.0	56.40	0.86	15.30	6.90	0.90	5.40	0.09
139	858A	04H	4	103	107	26.93	SLCY	non	33.6	57.60	0.85	15.60	7.10	0.80	5.70	0.08
139	858A	04H	5	102	106	28.42	SLCY	non	31.7	56.30	0.79	15.20				

Table 1 (continued).

MgO	CaO	Na ₂ O	Na ₂ OC	K ₂ O	P ₂₁₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC	Na ₂ OX	N	Total
wt%													
5.14	2.42	3.10	ND	2.01	0.23	4.80	0.18	1.70	0.20	0.40	ND	ND	100.70
5.14	2.33	2.71	ND	2.22	0.22	4.18	0.25	1.98	0.59	0.38	ND	0.04	100.09
5.22	2.27	2.80	2.68	2.23	0.21	4.90	0.23	2.00	0.30	0.50	0.12	ND	100.40
1.45	6.35	2.70	ND	0.79	0.10	2.91	0.17	1.90	1.58	0.09	ND	0.01	100.80
5.22	2.43	3.10	2.95	2.16	0.21	4.40	0.13	1.50	0.40	0.30	0.15	ND	100.70
4.48	2.43	3.40	3.22	2.10	0.22	4.10	0.20	1.50	0.20	0.40	0.18	ND	100.90
5.20	2.57	3.02	ND	2.00	0.22	3.90	0.56	1.43	0.55	0.24	ND	0.05	99.80
2.78	3.70	4.10	3.95	1.24	0.18	2.50	0.30	1.60	0.90	0.20	0.15	ND	99.80
4.94	2.51	3.26	ND	1.78	0.21	3.99	0.22	1.50	0.33	0.32	ND	0.03	100.61
4.33	2.75	3.80	3.62	1.57	0.22	3.70	0.24	1.20	0.20	0.30	0.18	ND	100.50
3.87	3.31	4.10	3.94	0.95	0.22	3.40	0.32	1.10	0.10	0.30	0.16	ND	100.40
3.06	4.04	4.20	4.04	0.61	0.21	2.60	0.41	1.30	0.50	0.20	0.16	ND	100.10
2.23	11.55	3.46	ND	0.49	0.20	2.00	0.00	7.69	6.89	0.22	ND	ND	99.80
5.25	3.28	4.10	3.97	0.59	0.24	4.00	0.27	0.70	ND	ND	0.13	ND	100.30
5.25	3.20	4.00	ND	0.59	0.24	5.80	0.40	0.10	ND	ND	ND	ND	100.40
5.37	2.48	3.73	ND	0.06	0.17	2.91	1.00	0.73	0.33	0.11	ND	ND	100.58
4.90	1.49	5.50	ND	0.06	0.18	3.00	0.47	0.30	ND	ND	ND	ND	99.40
4.33	5.91	3.12	ND	0.04	0.21	2.91	0.00	0.88	0.88	0.00	ND	ND	100.58
3.90	3.76	3.62	ND	0.05	0.18	2.54	0.73	0.48	0.04	0.12	ND	0.05	100.52
5.03	3.97	2.95	ND	0.03	0.18	3.27	0.35	0.59	0.04	0.15	ND	0.03	100.19
8.47	3.95	2.70	2.58	0.05	0.25	5.50	0.17	0.30	0.00	0.10	0.12	ND	101.40
11.90	5.13	2.20	ND	0.06	0.25	ND	1.57	0.10	ND	ND	ND	ND	95.50
2.01	4.86	2.60	2.44	0.05	0.15	2.70	0.05	0.70	0.00	0.20	0.16	ND	100.70
4.11	1.94	2.11	ND	0.06	0.13	2.91	0.26	0.08	0.04	0.01	ND	0.05	100.71
6.22	0.81	1.36	ND	0.00	0.12	0.00	ND	0.00	ND	ND	ND	ND	101.33
5.48	0.87	1.90	ND	0.05	0.13	3.40	0.02	0.30	ND	ND	ND	ND	100.70
5.54	1.81	2.10	ND	0.05	0.14	3.90	0.02	0.50	ND	ND	ND	ND	101.00
5.69	3.53	2.80	2.75	0.05	0.20	4.20	0.36	0.90	0.00	0.20	0.05	ND	100.50
3.05	8.70	0.20	0.12	0.05	0.19	ND	2.17	0.30	0.00	0.10	0.08	ND	98.50
3.32	3.06	0.40	0.39	0.05	0.15	ND	1.80	0.20	ND	ND	0.01	ND	98.30
2.21	7.01	0.40	ND	0.05	0.12	2.80	0.02	ND	ND	ND	ND	ND	100.20
4.19	4.08	4.00	3.93	0.05	0.22	3.40	0.02	0.60	ND	ND	0.07	ND	100.60
4.88	3.40	4.00	ND	0.05	0.20	ND	1.05	0.50	0.00	0.10	ND	ND	97.00
4.63	3.47	4.10	4.01	0.05	0.20	4.20	0.87	ND	ND	ND	0.09	ND	100.00
2.48	4.81	3.30	3.25	0.06	0.15	ND	2.82	0.30	0.00	0.10	0.05	ND	99.30
4.85	3.87	4.10	4.02	0.05	0.23	3.60	0.03	0.50	0.00	0.10	0.08	ND	100.90
4.18	4.25	3.80	3.71	0.05	0.22	3.20	0.70	0.40	0.00	0.10	0.09	ND	99.80
1.92	5.63	2.20	2.12	0.05	0.14	ND	3.05	0.10	ND	ND	0.08	ND	99.60
1.82	8.42	0.20	ND	0.05	0.11	1.80	0.07	0.10	ND	ND	ND	ND	99.70
3.93	3.00	4.30	ND	0.05	0.20	3.40	0.02	0.60	ND	ND	ND	ND	100.10
3.31	3.80	3.90	3.78	0.05	0.18	7.80	0.15	0.30	0.00	0.10	0.12	ND	104.80
3.05	4.59	3.40	3.32	0.05	0.17	3.80	0.06	0.10	ND	ND	0.08	ND	99.70
3.76	6.29	2.00	ND	0.05	0.15	3.20	0.13	ND	ND	ND	ND	ND	100.10
3.61	4.41	3.40	3.31	0.05	0.17	2.90	0.30	0.20	ND	ND	0.09	ND	99.50
4.45	3.98	4.00	ND	0.05	0.20	3.40	0.02	0.40	0.00	0.10	ND	ND	99.30
3.35	3.10	4.30	ND	0.05	0.16	2.00	0.45	0.40	ND	ND	ND	ND	100.10
4.07	6.32	3.60	3.48	0.05	0.23	3.00	0.10	0.20	ND	ND	0.12	ND	100.20
1.66	8.10	2.52	ND	0.00	0.17	1.53	0.60	1.21	1.21	0.00	ND	ND	100.17
2.19	8.09	3.00	2.89	0.05	0.18	2.10	0.02	0.10	ND	ND	0.11	ND	99.80
3.35	7.00	3.70	ND	2.48	0.19	4.80	0.18	ND	ND	ND	ND	ND	94.30
3.79	4.44	2.34	ND	2.25	0.21	5.27	0.00	4.40	1.87	0.69	ND	0.05	99.46
3.17	3.57	3.20	1.91	2.94	0.22	3.90	0.20	2.60	1.50	0.30	1.29	ND	98.50
3.64	4.05	3.60	2.37	2.12	0.20	4.60	0.20	3.50	1.10	0.70	1.23	ND	100.90
2.02	8.01	1.82	ND	3.36	0.24	3.93	0.32	3.22	2.12	0.30	ND	0.03	100.82
3.67	4.89	3.80	2.65	2.25	0.19	3.60	0.12	2.90	1.50	0.40	1.15	ND	100.50
3.41	7.88	3.70	2.06	2.22	0.16	4.80	0.51	6.80	4.40	0.70	1.64	ND	99.30
3.34	7.64	3.30	ND	2.51	0.15	5.00	0.41	ND	ND	ND	ND	ND	94.20
3.32	7.29	3.50	1.94	2.34	0.15	5.10	0.51	6.70	4.10	0.70	1.56	ND	99.10
3.60	2.77	3.30	2.30	2.81	0.18	3.90	0.15	2.00	0.60	0.40	1.00	ND	99.00
3.80	4.13	3.50	2.48	2.12	0.18	ND	1.32	2.40	0.90	0.40	1.02	ND	96.00
3.87	5.18	3.50	2.31	2.32	0.19	5.50	0.17	3.60	2.10	0.40	1.19	ND	99.70
3.58	2.86	3.40	2.46	2.77	0.17	4.10	0.20	1.90	0.50	0.40	0.94	ND	99.70
4.12	4.05	3.90	2.57	2.28	0.20	4.40	0.31	2.40	0.90	0.40	1.33	ND	99.80
1.74	30.10	1.50	ND	0.78	0.14	ND	1.00	23.30	22.30	0.30	ND	ND	97.20
1.22	40.90	0.80	ND	0.64	0.13	1.90	0.50	30.60	ND	ND	ND	ND	99.50
3.57	3.55	3.40	2.48	2.31	0.18	5.00	0.25	2.20	0.90	0.40	0.92	ND	100.00
1.72	29.30	1.60	ND	0.73	0.19	ND	1.00	22.10	ND	ND	ND	ND	95.80
3.24	18.30	2.50	1.70	1.09	0.23	ND	1.10	13.70	11.40	0.60	0.80	ND	96.10
3.26	5.66	3.20	2.05	2.47	0.19	ND	1.43	4.60	2.80	0.50	1.15	ND	96.50
3.60	3.65	2.23	ND	2.71	0.18	3.40	0.30	2.27	1.28	0.27	ND	0.03	99.63
3.34	3.30	3.20	ND	2.60	0.17	3.50	0.24	2.00	ND	ND	ND	ND	100.50
3.28	3.50	3.40	2.54	2.49	0.17	3.30	0.34	2.20	0.80	0.40	0.86	ND	99.80
2.98	3.10	3.60	2.62	2.10	0.19	3.40	0.50	1.90	0.40	0.40	0.98	ND	99.10
2.24	19.40	ND	ND	ND	0.36	ND	0.40	ND	ND	ND	ND	ND	ND
3.13	2.45	3.30	2.41	2.22	0.17	3.70	0.44	1.80	0.10	0.50	0.89	ND	99.20
2.43	6.24	2.70	2.70	2.48	0.19	3.80	0.41	4.90	ND	ND	0.00	ND	101.20
3.14	3.58	2.70	1.97	3.46	0.18	4.20	0.11	3.00	1.80	0.30	0.73	ND	100.50
3.48	2.25	2.70	1.76	3.56	0.19	ND	1.11	2.20	0.80	0.40	0.94	ND	96.60
3.55	3.36	1.71	ND	3.71	0.20	3.84	0.72	3.08	1.61	0.40	ND	0.06	100.71
2.36	4.98	2.70	2.11	2.53	0.18	2.70	0.33	3.40	2.70	0.20	0.59	ND	99.00
3.34	2.96	2.90	1.92	2.30	0.17	3.80	0.21	3.10	1.30	0.50	0.98	ND	98.80
3.73	1.95	2.70	1.88	3.50	0.17	4.20	0.56	2.50	0.60	0.50	0.82	ND	100.10
3.35	4.60	2.60	1.78	3.64	0.19	1.90	0.30	4.00	2.70	0.40	0.82	ND	99.10
3.11	3.22	2.70	1.74	3.84	0.20	3.90	0.68	2.90	1.70	0.30	0.96	ND	99.50
3.42	2.33	2.60	1.86	4.16	0.19	4.30	0.36	2.30	0.90	0.40	0.74	ND	100.30
2.81	4.42	2.50	1.75	4.09	0.18	3.60	0.87	3.90	2.70	0.30	0.75	ND	99.30
3.91	2.70	2.50	ND	4.47	0.39	3.80	0.31	2.30	1.00	0.40	ND	ND	99.60
3.10	2.88	2.50	1.79	3.89	0.23	3.30	0.29	2.10	1.20	0.20	0.71	ND	99.50

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Lithology	Induration	Moisture	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO
									wt%							
139	858B	02H	5	16	18	13.36	SLSC	moderate	0.0	64.40	0.58	12.30	7.30	ND	ND	0.08
139	858B	02H	5	35	37	13.55	SLCY	non	31.7	67.20	0.51	10.80	6.40	ND	ND	0.09
139	858B	02H	6	69	71	15.39	SLCY	non	35.0	60.70	0.72	14.30	6.70	0.20	5.90	0.09
139	858B	02H	6	75	77	15.45	SLSC	moderate	1.6	60.90	0.73	14.50	6.50	0.20	6.00	0.09
139	858B	05H	1	117	121	25.07	SLSC	moderate	3.4	37.60	0.60	11.50	6.00	ND	ND	0.21
139	858B	05H	1	122	125	25.12	SLSC	non	ND	42.97	0.84	15.32	4.99	ND	ND	0.30
139	858B	05H	1	140	143	25.30	SLCY	non	40.0	41.20	0.58	9.30	3.90	0.90	2.70	0.20
139	858B	05H	3	21	24	27.11	SLCY	non	27.5	42.30	0.50	9.20	5.20	0.20	4.50	0.21
139	858B	05H	3	118	121	28.08	SLSC	moderate	3.5	38.20	0.62	12.40	5.40	ND	ND	0.21
139	858B	05H	3	124	128	28.14	SLSC	moderate	ND	43.51	0.74	13.75	5.64	ND	ND	0.26
139	858B	05H	4	27	29	28.67	SLSC	moderate	5.3	35.50	0.72	14.40	5.20	0.30	4.40	0.22
139	858B	05H	4	33	37	28.73	SLSC	moderate	9.3	54.00	0.16	3.80	2.80	0.20	2.30	0.11
139	858C	01H	1	52	56	0.52	SLCY	non	48.1	44.70	0.66	13.20	6.30	ND	ND	0.10
139	858C	01H	2	38	42	1.88	SLSC	indurated	1.8	55.20	0.97	16.00	7.20	3.90	3.00	0.08
139	858C	01H	2	42	46	1.92	SLST	indurated	ND	61.32	1.12	17.70	7.96	ND	ND	0.10
139	858C	01H	3	17	21	3.17	SLSC	indurated	1.9	52.90	0.81	15.70	7.00	1.40	5.00	0.09
139	858C	02H	1	88	91	4.38	SLCY	indurated	1.8	51.00	0.78	14.80	7.30	3.00	3.90	0.11
139	858C	02H	2	15	17	5.15	SLCY	non	37.6	50.70	0.75	15.40	7.00	3.00	3.60	0.10
139	858C	02H	2	77	79	5.77	SLCY	non	ND	56.83	0.87	16.94	8.23	ND	ND	0.13
139	858C	02H	4	15	17	8.15	SLCY	non	45.5	49.90	0.69	14.70	6.80	2.80	3.60	0.11
139	858C	02H	4	72	75	8.72	SLCY	non	1.8	48.30	0.64	14.00	7.00	2.40	4.10	0.08
139	858C	02H	5	32	34	9.82	SLCY	indurated	8.7	25.00	0.38	7.50	3.50	ND	ND	0.14
139	858C	02H	6	78	81	11.78	SLSC	indurated	1.5	53.40	0.83	16.20	7.70	1.60	5.50	0.12
139	858C	02H	6	110	112	12.10	SLCY	moderate	30.4	54.00	0.86	15.70	8.10	ND	ND	0.11
139	858C	02H	7	15	17	12.65	SLCY	moderate	23.8	53.80	0.79	16.00	8.00	ND	ND	0.16
139	858C	03H	1			14.00	SLSC	indurated	ND	58.20	0.80	15.60	7.20	ND	ND	0.10
139	858C	03H	1	24	26	13.24	SLCY	indurated	8.6	34.70	0.45	9.10	4.40	ND	ND	0.23
139	858C	03H	1	29	30	13.29		moderate	ND	10.20	0.13	2.90	1.50	ND	ND	0.19
139	858C	03H	1	49	51	13.48	SLCY	moderate	19.8	ND	ND	ND	ND	ND	ND	ND
139	858C	03H	1	78	81	13.78	SLST	indurated	6.1	14.90	0.18	3.90	2.20	ND	ND	0.35
139	858C	03H	1	108	110	14.08	SLCY	non	38.0	60.00	0.67	14.10	7.00	ND	ND	0.07
139	858C	03H	1	145	150	14.45	SLCY	indurated	13.9	27.20	0.31	6.60	2.70	ND	ND	0.22
139	858C	03H	2	10	15	14.60	SLCY	Indurated	15.9	22.70	0.33	6.30	3.70	ND	ND	0.35
139	858C	03H	2	36	38	14.86	SLCY	moderate	19.0	13.40	0.30	5.80	2.80	ND	ND	0.49
139	858C	03H	2	54	57	15.04	SNSL	moderate	27.5	13.60	0.31	6.00	3.10	ND	ND	0.34
139	858C	03H	2	110	115	15.60	SNSL	indurated	ND	8.70	0.20	3.80	1.70	ND	ND	0.54
139	858C	03H	2	124	126	15.74	SNSL	Indurated	18.6	13.70	0.34	6.80	3.80	ND	ND	0.53
139	858C	03H	2	133	135	15.83	SLCS	weak	ND	49.49	0.87	15.36	13.96	ND	ND	0.16
139	858C	03H	2	136	139	15.86	SAND	weak	ND	66.10	0.58	11.80	5.30	ND	ND	0.06
139	858C	03H	3	2	4	16.02	SAND	weak	ND	73.10	0.51	10.10	3.50	ND	ND	0.04
139	858C	03H	3	22	24	16.22	SILT	non	11.3	52.50	0.29	7.20	2.50	ND	ND	0.10
139	858C	03H	3	38	41	16.38	SLSC	indurated	1.6	19.40	0.19	4.10	3.60	ND	ND	0.29
139	858C	03H	3	68	70	16.68	SLCY	moderate	26.7	68.90	0.44	11.40	5.00	ND	ND	0.03
139	858C	03H	3	78	80	16.78	SILT	indurated	ND	17.40	0.20	4.10	4.80	ND	ND	0.37
139	858C	03H	3	107	109	17.07	SILT	weak	ND	67.90	0.57	12.50	4.40	ND	ND	0.03
139	858C	03H	3	122	124	17.22	SLCY	weak	21.3	58.20	0.52	10.40	5.00	ND	ND	0.05
139	858C	03H	4	77	80	18.27	SILT	weak	1.7	67.90	0.63	13.50	3.90	ND	ND	0.02
139	858C	03H	5	58	60	19.58	SILT	weak	ND	65.10	0.62	14.30	5.60	ND	ND	0.04
139	858C	03H	6	86	89	21.36	SILT	weak	1.6	63.70	0.71	14.10	5.60	ND	ND	0.04
139	858C	03H	6	86	89	21.36	SILT	weak	ND	63.70	0.71	14.10	5.60	ND	ND	0.04
139	858C	03H	7	6	9	22.06	SILT	weak	12.5	62.80	0.66	13.90	4.30	ND	ND	0.05
139	858C	05H	1	72	75	24.22	SILT	weak	1.8	58.50	0.62	12.60	4.80	ND	ND	0.08
139	858C	05H	1	122	124	24.72	SLCY	weak	19.8	64.70	0.72	12.00	4.40	ND	ND	0.06
139	858C	05H	2	18	20	25.18	SLCY	moderate	31.9	55.50	0.67	14.40	10.90	ND	ND	0.08
139	858C	05H	2	106	108	26.06	SILT	moderate	ND	60.20	0.75	15.40	6.40	ND	ND	0.07
139	858C	05H	2	122	123	26.22	SILT	moderate	ND	62.80	0.91	18.76	6.09	ND	ND	0.07
139	858C	05H	3	5	7	26.55	SLCY	moderate	20.5	64.00	0.68	13.20	5.90	ND	ND	0.05
139	858C	05H	3	19	21	26.69	SILT	moderate	ND	61.40	0.77	16.40	4.90	ND	ND	0.06
139	858C	05H	3	61	63	27.11	SLCY	weak	21.2	62.30	0.65	12.90	6.20	ND	ND	0.07
139	858C	05H	4	27	28	28.27	SILT	indurated	9.2	32.50	0.49	7.70	5.50	ND	ND	0.22
139	858C	05H	4	55	57	28.55	SNSL	moderate	22.1	61.20	0.79	14.60	6.40	ND	ND	0.06
139	858C	05H	4	93	95	28.93	SILT	moderate	ND	58.60	0.79	14.40	6.30	ND	ND	0.08
139	858C	05H	5	21	23	29.71	SSSL	moderate	24.0	63.00	0.77	13.60	5.30	ND	ND	0.06
139	858C	05H	5	88	90	30.38	SILT	moderate	1.9	58.90	0.77	14.30	4.80	ND	ND	0.09
139	858C	05H	CC	7	10	33.20	SILT	Indurated	10.1	68.60	0.81	12.00	4.30	ND	ND	0.05
139	858C	06H	1	19	21	33.19	SSSL	moderate	19.8	65.00	0.79	12.90	5.90	ND	ND	0.06
139	858C	06H	1	80	82	33.80	SNSL	Indurated	1.8	65.50	0.72	13.00	5.30	ND	ND	0.07
139	858C	06H	1	123	125	34.23	SLCS	moderate	26.7	51.80	0.62	13.70	9.03	ND	ND	0.09
139	858C	06H	2	75	77	35.25	SLCY	moderate	18.0	63.30	0.85	13.90	6.10	ND	ND	0.09
139	858C	06H	2	135	137	35.85	SLSC	moderate	26.4	58.00	0.88	16.00	6.80	0.20	6.20	0.13
139	858C	06H	3	51	53	36.51	SLCY	indurated	23.4	56.40	0.80	15.40	8.10	ND	ND	0.12
139	858C	06H	3	104	106	37.04	SLST	indurated	ND	61.99	0.93	16.34	8.44	ND	ND	0.13
139	858C	06H	3	108	110	37.08	SILT	moderate	3.0	57.80	0.82	15.60	7.10	ND	ND	0.13
139	858C	06H	4	43	51	37.93	SLCS	indurated	6.7	17.80	0.23	4.39	1.98	ND	ND	0.45
139	858C	06H	5	45	48	39.45	SILT	moderate	11.5	62.80	0.70	12.70	6.90	ND	ND	0.07
139	858C	06H	5	76	79	39.76	SLCS	Indurated	19.0	60.40	0.84	14.80	5.90	0.20	5.30	0.11
139	858C	06H	6	52	55	41.02	SNSL	indurated	3.2	23.40	0.30	5.10	1.90	ND	ND	0.03
139	858C	07H	1	11	12	41.61	SILT	moderate	1.9	59.00	0.74	14.60	6.40	ND	ND	0.13
139	858C	07H	1	90	92	42.40	SSSL	moderate	17.8	64.50	0.66	13.00	7.10	ND	ND	0.06
139	858C	07H	2	53	55	43.53	SSSL	moderate	ND	62.72	0.93	15.99	8.01	ND	ND	0.14
139	858C	07H	2	55	58	43.55	SILT	moderate	ND	58.60	0.81	14.90	6.90	ND	ND	0.11
139	858C	07H	2	60	64	43.60	SLCS	indurated	27.6	50.00	0.93	17.70	8.90	ND	ND	0.14
139	858C	07H	2	143	146	44.43	SILT	moderate	1.8	59.10	0.78	14.60	7.00	ND	ND	0.14
139	858C	10X	CC	2	4	49.52	SILT	moderate	ND	63.80	0.76	13.60	5.90	ND	ND	0.10
139	858C	10X	CC	37	39	49.87	SLST</									

Table 1 (continued).

MgO	CaO	Na ₂ O	Na ₂ OC	K ₂ O	P ₂₁₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC	Na ₂ OX	N	Total
wt%													
4.53	0.94	2.30	ND	1.31	0.15	ND	2.30	0.60	0.00	0.20	ND	ND	96.90
4.27	1.90	1.90	1.10	1.34	0.13	ND	1.71	1.40	0.60	0.20	0.80	ND	97.80
6.23	0.77	2.20	1.38	1.77	0.18	5.10	0.72	0.70	0.00	0.20	0.82	ND	99.60
6.48	0.74	2.30	ND	1.68	0.18	5.30	0.58	0.80	0.00	0.20	ND	ND	100.20
26.90	2.22	1.00	0.10	0.22	0.04	ND	1.93	1.30	0.10	0.30	0.90	ND	89.70
34.18	1.57	0.01	ND	0.01	0.01	12.51	0.56	0.92	0.29	0.17	ND	0	100.20
28.20	1.91	1.30	ND	0.11	0.07	10.30	0.05	1.00	ND	ND	ND	ND	97.90
28.10	1.34	0.80	ND	0.07	0.03	10.90	0.85	0.90	0.17	0.20	ND	ND	99.90
27.90	1.44	0.80	ND	0.20	0.03	ND	1.40	0.90	0.17	0.20	ND	ND	89.60
34.08	1.66	0.13	ND	0.03	0.02	12.87	0.88	0.62	0.29	0.09	ND	0	99.82
28.20	1.45	0.90	0.20	0.08	0.04	12.20	0.76	1.00	0.00	0.30	0.70	ND	100.20
29.60	0.79	0.50	0.14	0.05	0.06	8.60	0.17	0.30	0.00	0.10	0.36	ND	100.70
3.35	10.40	3.40	1.78	2.04	0.16	5.20	0.93	9.50	6.60	0.80	1.62	ND	100.20
3.14	3.48	3.20	ND	3.01	0.23	5.10	0.15	2.30	1.20	0.30	ND	ND	99.90
3.46	3.76	1.80	ND	3.28	0.24	4.47	0.24	2.75	1.76	0.27	ND	0.03	100.74
3.29	4.74	3.40	ND	2.66	0.18	5.30	0.60	3.80	ND	ND	ND	ND	100.10
3.57	7.06	3.40	2.63	1.99	0.20	4.60	0.27	4.80	3.40	0.40	0.77	ND	99.60
3.57	6.22	3.40	2.15	2.36	0.19	4.80	0.39	4.60	3.20	0.40	1.25	ND	100.00
3.98	7.86	2.65	ND	2.45	0.20	4.20	0.35	6.04	4.14	0.52	ND	0.04	100.14
3.70	7.32	3.50	ND	2.40	0.15	5.00	0.30	5.90	4.10	0.50	ND	ND	100.20
3.58	7.52	3.60	2.02	2.51	0.14	5.20	0.60	6.00	4.30	0.50	1.58	ND	98.90
2.05	29.00	1.40	0.96	0.74	0.22	ND	1.23	22.50	22.30	0.10	0.44	ND	95.80
4.27	4.46	2.80	2.00	2.82	0.21	4.70	0.46	3.50	2.10	0.40	0.80	ND	101.00
3.94	3.47	2.90	2.00	2.84	0.22	ND	1.60	2.50	1.20	0.40	0.90	ND	96.50
3.37	3.79	2.90	2.20	3.06	0.20	ND	2.63	2.80	1.60	0.30	0.70	ND	97.70
2.21	2.03	3.50	2.46	3.25	0.17	ND	3.70	1.20	0.00	0.30	1.04	ND	98.30
1.24	23.80	1.90	1.44	1.30	0.20	ND	2.90	17.60	17.10	0.10	0.46	ND	98.00
1.10	44.40	0.50	ND	0.34	0.13	ND	1.02	34.50	0.00	0.00	ND	ND	97.30
ND	ND	ND	0.00	ND	ND	ND	ND	ND	ND	ND	0.49	ND	ND
0.91	40.90	0.60	0.45	0.57	0.26	ND	1.67	32.70	32.40	0.10	0.15	ND	99.20
1.50	1.14	3.00	1.92	3.74	0.13	ND	4.71	1.40	0.00	0.40	1.08	ND	97.70
0.98	31.60	1.20	0.76	1.04	0.16	ND	1.90	24.10	24.40	0.00	0.44	ND	98.10
1.11	33.00	1.20	0.84	1.04	0.29	ND	2.70	25.90	25.50	0.10	0.36	ND	98.70
1.35	40.40	0.70	0.19	0.72	0.20	ND	1.95	31.00	31.10	0.00	0.51	ND	99.20
1.60	38.00	0.80	0.25	0.65	0.17	ND	2.25	30.10	29.80	0.10	0.55	ND	97.00
1.02	44.50	0.50	0.00	0.44	0.10	ND	1.34	35.00	35.70	0.00	0.54	ND	97.90
1.37	37.40	0.90	0.17	0.79	0.14	ND	2.70	28.60	28.20	0.10	0.73	ND	97.10
0.92	8.14	1.12	ND	5.75	0.24	2.06	6.55	6.89	4.29	0.71	ND	0.03	96.01
0.61	1.95	1.80	1.25	5.18	0.15	ND	4.03	2.00	0.70	0.40	0.55	ND	99.80
0.43	2.23	1.70	ND	3.72	0.13	ND	2.55	1.20	0.40	0.20	ND	ND	99.40
0.36	16.70	1.10	0.63	2.40	0.07	ND	1.96	12.60	12.50	0.00	0.47	ND	98.00
0.37	37.20	0.60	0.29	0.93	0.13	ND	2.93	29.00	29.50	0.00	0.31	ND	98.90
0.55	0.93	1.70	1.03	4.91	0.12	ND	3.76	0.80	0.00	0.20	0.67	ND	99.00
0.50	36.90	0.70	0.50	0.92	0.13	ND	4.04	29.10	29.20	0.00	0.20	ND	99.30
0.62	1.47	2.00	ND	4.92	0.14	ND	3.04	1.40	0.20	0.30	ND	ND	99.40
0.52	7.86	1.90	1.28	3.73	0.12	ND	3.90	5.70	5.00	0.20	0.62	ND	98.30
0.67	2.05	3.30	2.59	3.41	0.17	ND	2.50	0.70	0.00	0.20	0.71	ND	99.00
1.11	1.08	2.50	1.95	4.02	0.15	ND	3.20	0.80	0.00	0.20	0.55	ND	98.70
1.18	1.30	3.00	2.45	4.08	0.17	ND	3.10	1.00	0.00	0.30	0.55	ND	98.20
1.18	1.30	3.00	2.45	4.08	0.17	ND	3.10	1.00	0.00	0.30	0.55	ND	98.20
1.16	3.13	3.20	2.63	3.76	0.16	ND	2.10	2.10	0.70	0.40	0.57	ND	97.50
1.64	7.00	2.10	1.49	3.42	0.16	ND	1.80	5.20	4.50	0.20	0.61	ND	98.10
1.67	5.22	2.60	2.13	2.01	0.19	ND	1.44	3.40	2.70	0.20	0.47	ND	98.50
2.68	2.61	3.19	2.35	2.08	0.19	ND	5.60	1.80	0.60	0.30	0.84	ND	99.80
2.55	2.57	3.00	ND	3.00	0.19	ND	2.11	1.80	0.40	0.40	ND	ND	98.20
3.63	1.51	1.93	ND	4.27	0.20	3.13	1.23	1.65	1.65	0.00	ND	0	100.17
1.93	2.74	2.70	2.16	2.41	0.18	ND	2.42	1.50	0.70	0.20	0.54	ND	97.90
3.25	0.93	2.90	1.75	3.66	0.19	3.60	0.51	1.20	0.00	0.30	1.15	ND	100.00
2.82	3.59	2.20	1.59	2.64	0.17	ND	2.50	2.70	2.00	0.20	0.61	ND	98.90
1.57	25.30	1.40	ND	1.28	0.12	ND	3.00	19.90	18.80	0.30	ND	ND	99.10
2.44	1.49	2.10	1.49	4.86	0.17	ND	2.80	1.60	0.30	0.40	0.61	ND	98.80
3.00	2.74	2.50	1.48	4.25	0.17	ND	2.34	2.60	1.10	0.40	1.02	ND	98.00
2.96	1.54	2.10	1.49	4.17	0.18	ND	2.25	1.20	0.00	0.30	0.61	ND	97.40
4.49	2.76	2.10	1.14	3.85	0.18	ND	1.22	2.80	1.50	0.40	0.96	ND	96.50
2.51	1.02	2.30	1.77	3.93	0.21	ND	1.70	0.70	0.00	0.20	0.53	ND	98.40
3.32	1.39	3.10	2.56	2.45	0.20	ND	2.10	0.30	0.00	0.10	0.54	ND	97.70
3.99	1.07	3.10	2.40	2.28	0.19	ND	1.16	0.40	0.00	0.10	0.70	ND	97.00
4.54	4.77	2.37	1.70	2.84	0.18	ND	5.90	0.70	0.00	0.20	0.67	ND	96.70
4.23	1.07	3.20	2.62	2.35	0.23	ND	1.40	0.50	0.00	0.10	0.58	ND	97.40
6.68	0.90	3.30	2.67	1.41	0.24	5.10	0.44	0.60	0.00	0.20	0.63	ND	99.90
6.61	0.81	3.10	2.47	1.87	0.22	ND	2.12	0.90	0.00	0.20	0.63	ND	96.60
6.79	0.75	2.36	ND	2.16	0.22	4.38	1.36	0.81	0.07	0.20	ND	0	100.11
6.27	0.78	3.40	2.59	1.68	0.22	ND	1.04	0.70	0.00	0.20	0.81	ND	95.70
10.00	23.70	0.71	0.48	0.40	0.11	ND	8.40	15.20	14.70	0.10	0.23	ND	83.50
3.67	1.54	3.10	2.63	2.21	0.18	ND	3.00	0.40	0.00	0.10	0.47	ND	97.50
5.97	0.98	3.40	2.47	1.47	0.22	4.60	0.44	0.50	0.00	0.10	0.93	ND	99.20
2.20	26.10	1.20	1.13	0.51	0.09	ND	15.00	0.20	0.00	0.00	0.07	ND	76.20
7.47	0.66	3.50	2.61	1.07	0.24	4.80	0.90	0.80	0.00	0.20	0.89	ND	100.40
3.32	0.65	2.50	2.10	2.44	0.17	ND	3.55	0.40	0.00	0.10	0.40	ND	98.50
7.59	0.66	2.90	ND	0.83	0.24	4.38	1.95	0.84	0.04	0.22	ND	0.01	100.01
6.31	0.63	3.70	3.00	0.90	0.22	ND	1.36	0.80	0.00	0.20	0.70	ND	95.30
7.11	0.82	3.90	3.27	2.76	0.27	ND	2.21	1.00	0.00	0.30	0.63	ND	96.00
7.13	0.66	4.10	ND	0.56	0.20	4.50	0.81	0.90	0.00	0.20	ND	ND	100.60
4.84	0.99	4.10	3.60	0.24	0.20	ND	1.03	0.60	0.00	0.20	0.50	ND	96.30
3.49	1.61	2.95	ND	1.41	0.18	2.32	1.53	0.29	0.04	0.07	ND	0	100.46
3.88	0.85	3.40	3.02	0.67	0.17	ND	3.42	0.50	0.00	0.10	0.38	ND	98.00
4.24	6.64	2.93	ND	2.25	0.23	4.47	1.34	0.77	0.07	0.19	ND	0.01	99.80
4.13	0.82	2.80	2.45	0.76	0.15	ND	1.60	0.30	0.00	0.10	0.35	ND	96.80

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Lithology	Induration	Moisture	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO
									wt%							
139	858A	05H	2	2	4	32.42	SLCY	indurated	ND	19.60	0.30	6.10	3.00	0.20	2.60	0.97
139	858A	05H	2	134	137	33.74	SLCY	weak	3.1	57.20	0.74	12.00	4.40	ND	ND	0.16
139	858A	05H	3	100	105	34.90	SAND	weak	ND	64.38	0.92	16.14	6.70	ND	ND	0.09
139	858A	05H	3	71	75	34.61	SLCY	weak	27.5	57.30	0.86	15.80	7.50	1.20	5.70	0.10
139	858A	05H	4	27	30	35.67	SILT	moderate	14.5	58.50	0.72	12.50	5.10	1.10	3.60	0.10
139	858A	05H	5	54	57	37.44	SLSC	weak	19.5	59.90	0.79	14.40	6.60	1.70	4.40	0.08
139	858A	05H	6	40	45	38.80	SLCY	moderate	3.8	30.90	0.45	9.20	4.00	ND	ND	0.61
139	858A	05H	6	76	80	39.16	SILT	moderate	1.8	54.10	0.80	15.30	6.90	1.20	5.10	0.10
139	858A	05H	CC	10	11	40.00	SILT	moderate	1.9	21.90	0.33	6.70	3.00	0.20	2.60	0.96
139	858A	06H	1	74	76	41.14	SLCY	moderate	29.3	56.80	0.83	15.90	6.90	1.20	5.10	0.08
139	858A	06H	1	114	117	41.54	SILT	moderate	0.0	54.70	0.83	16.20	8.00	1.20	6.10	0.09
139	858A	06H	2	94	96	42.84	SILT	moderate	ND	59.59	0.99	17.71	8.68	ND	ND	0.10
139	858A	06H	3	77	79	44.17	SLCY	moderate	25.0	58.40	0.86	14.90	6.60	1.40	4.70	0.08
139	858A	06H	3	88	91	44.28	SILT	moderate	ND	56.20	0.87	15.80	7.70	0.80	6.20	0.08
139	858A	07H	1	77	80	50.67	SILT	moderate	0.0	61.80	0.90	13.90	5.30	1.20	3.70	0.07
139	858A	07H	2	63	66	52.03	SLCY	moderate	0.0	60.50	0.86	14.80	6.30	1.30	4.50	0.06
139	858A	07H	4	83	86	55.23	SILT	moderate	0.0	63.80	0.61	12.60	4.00	0.60	3.10	0.08
139	858A	07H	4	88	91	55.28	SNSL	non	16.3	63.60	0.69	12.60	4.20	1.10	2.80	0.08
139	858A	07H	4	93	97	55.33	SAND	weak	ND	65.81	0.84	14.92	6.27	ND	ND	0.08
139	858A	07H	5	54	57	56.44	SILT	moderate	0.0	56.00	0.83	15.80	7.30	1.30	5.40	0.09
139	858A	07H	6	67	71	58.07	SILT	moderate	18.8	62.00	0.78	14.30	5.70	1.50	3.80	0.07
139	858A	08H	1	28	30	59.18	SLSN	weak	ND	63.40	0.69	13.50	5.10	1.30	3.40	0.06
139	858A	08H	2	31	33	60.64	SLSC	moderate	1.6	59.30	0.74	14.00	5.80	1.40	4.00	0.08
139	858A	08H	2	39	41	60.72	SLSC	moderate	ND	59.50	1.11	16.33	8.60	ND	ND	0.14
139	858A	08H	2	89	91	61.22	SLCY	weak	23.8	58.30	0.87	15.80	7.30	1.90	4.90	0.07
139	858A	09X	1	92	95	63.42	SLCY	moderate	30.0	56.70	0.84	16.00	7.20	1.40	5.20	0.08
139	858A	09X	2	38	40	64.38	SLSC	moderate	0.0	57.90	0.84	15.40	7.00	1.10	5.30	0.07
139	858A	09X	2	114	116	65.14	SLSC	moderate	20.7	59.40	0.83	14.30	6.10	1.40	4.20	0.08
139	858A	09X	3	108	112	66.58	SNSL	indurated	ND	48.10	0.75	11.80	4.50	0.80	3.30	0.26
139	858A	09X	4	47	51	67.47	SNSL	moderate	ND	60.95	0.96	17.45	8.04	ND	ND	0.09
139	858A	09X	4	52	56	67.52	SLCY	moderate	18.7	59.00	0.84	15.20	6.60	ND	ND	0.08
139	858A	09X	5	36	40	68.86	SLCY	moderate	23.3	54.30	0.83	16.30	7.70	1.30	5.80	0.08
139	858A	09X	6	110	114	71.10	SLCY	moderate	22.5	45.40	0.65	12.90	5.60	ND	ND	0.06
139	858A	09X	6	129	133	71.29	SNSL	indurated	1.8	55.10	0.85	15.70	7.30	1.30	5.40	0.09
139	858A	11X	1	2	7	72.92	SNSL	indurated	ND	64.27	0.79	12.93	5.06	ND	ND	0.16
139	858A	11X	CC	10	12	73.57	SNST	moderate	17.3	63.90	0.78	14.00	5.60	0.70	4.40	0.06
139	858A	11X	CC	17	21	73.64	SNSL	indurated	1.6	59.40	0.76	14.50	6.00	0.80	4.70	0.08
139	858A	12X	1	18	20	81.78	SNSL	indurated	ND	62.35	0.74	16.61	7.63	ND	ND	0.26
139	858A	12X	CC	11	13	81.91	SNSL	indurated	ND	8.10	0.15	3.10	2.50	ND	ND	0.48
139	858A	14X	CC	11	13	101.11	SNSL	indurated	16.3	58.80	0.78	15.70	6.80	0.80	5.40	0.07
139	858A	15X	1	35	37	110.95	SNST	indurated	1.3	59.90	0.74	14.80	5.70	0.20	5.20	0.08
139	858A	15X	1	60	62	111.20	SNST	indurated	ND	67.95	0.78	15.11	4.94	ND	ND	0.12
139	858A	16X	1	3	5	120.33	SLCY	moderate	20.0	55.10	0.87	15.80	7.40	0.50	6.20	0.09
139	858A	16X	1	38	40	120.68	CLST	indurated	1.9	50.50	0.74	15.40	7.30	ND	ND	0.11
139	858A	18X	1	116	118	140.76	SLCS	moderate	14.8	52.00	0.85	15.90	8.50	ND	ND	0.13
139	858A	18X	2	109	111	142.19	SLCS	moderate	21.3	51.50	0.84	15.70	8.20	ND	ND	0.10
139	858A	18X	3	14	16	142.74	SLCS	moderate	7.5	53.80	0.83	16.70	8.40	0.60	7.00	0.14
139	858A	18X	3	16	20	142.76	SLCS	moderate	ND	60.10	0.96	16.74	8.49	ND	ND	0.13
139	858A	19X	1	28	30	149.58	SLCS	moderate	1.7	54.80	0.85	17.20	8.60	0.90	6.90	0.12
139	858A	20X	1	62	64	159.62	SLCS	moderate	0.0	56.90	0.87	16.90	7.60	0.40	6.50	0.11
139	858A	20X	1	128	130	160.28	SLCS	moderate	16.7	56.20	0.85	17.20	7.90	0.50	6.70	0.11
139	858A	20X	3	39	41	162.32	SNST	indurated	10.0	61.10	0.63	13.50	4.80	ND	ND	0.08
139	858A	20X	4	100	103	164.44	SLCS	moderate	17.4	54.20	0.87	16.30	7.90	0.50	6.70	0.12
139	858A	21X	1	117	120	169.77	SLCS	moderate	19.7	55.60	0.83	17.20	8.00	0.80	6.50	0.12
139	858A	21X	2	31	34	170.41	SLCS	moderate	18.8	58.90	0.82	15.60	6.70	0.30	5.80	0.11
139	858A	21X	3	57	59	171.98	SLST	moderate	15.7	65.30	0.73	13.40	4.90	ND	ND	0.08
139	858A	23X	1	73	75	188.63	SLST	indurated	17.6	61.90	0.87	14.50	7.20	ND	ND	0.14
139	858A	23X	1	113	115	189.03	SLST	indurated	1.7	54.90	0.92	16.60	7.90	0.20	7.10	0.21
139	858A	24X	1	33	35	197.93	SLST	indurated	17.5	56.60	0.74	16.70	6.40	0.30	5.50	0.15
139	858A	24X	1	72	74	198.32	SLCS	indurated	0.0	54.30	0.89	17.50	8.50	0.50	7.20	0.21
139	858A	25X	1	29	32	207.59	SLST	indurated	13.8	57.10	0.89	17.00	7.60	0.20	7.00	0.13
139	858A	26X	CC	4	6	216.94	SLCS	indurated	14.9	54.40	0.89	16.90	8.80	ND	ND	0.15
139	858A	27X	1	33	35	226.93	SLST	indurated	13.4	61.40	0.79	14.60	6.10	ND	ND	0.10
139	858A	28X	CC	4	5	236.24	SLST	indurated	10.2	59.30	0.74	13.40	5.60	ND	ND	0.09
139	858A	29X	1	30	32	246.20	SNST	indurated	8.6	55.30	0.53	12.20	3.80	ND	ND	0.06
139	858A	30X	1	4	8	255.64	SLCS	indurated	18.2	54.40	0.93	16.80	9.10	ND	ND	0.15
139	858A	30X	1	67	70	256.27	SLCS	indurated	12.7	56.20	0.92	16.90	7.20	0.20	6.60	0.14
139	858A	31X	1	65	67	265.95	SLCS	indurated	11.8	55.30	0.90	17.40	7.90	ND	ND	0.13
139	858A	35X	CC	5	6	301.45	SNST	indurated	1.9	65.50	0.69	13.70	4.40	ND	ND	0.08
139	858B	01H	2	21	23	1.71	SLCY	non	75.0	43.30	0.12	3.40	11.10	ND	ND	0.12
139	858B	01H	2	42	44	1.92	SLCY	non	ND	54.81	0.27	6.27	9.22	ND	ND	0.15
139	858B	01H	2	50	54	2.00	SLCY	non	54.1	47.10	0.66	13.90	9.50	ND	ND	0.09
139	858B	01H	3	23	27	3.23	SILT	non	ND	60.51	1.10	17.55	7.65	ND	ND	0.11
139	858B	01H	4	67	71	5.17	SLCY	non	41.8	53.90	0.72	14.50	8.60	ND	ND	0.08
139	858B	01H	5	14	18	6.14	SLCY	non	39.8	51.90	0.79	15.20	7.00	2.10	4.40	0.12
139	858B	01H	5	21	25	6.21	SILT	non	ND	59.68	0.95	18.03	8.47	ND	ND	0.12
139	858B	01H	CC	8	12	6.98	SLCY	non	33.7	54.80	0.83	15.60	7.90	ND	ND	0.12
139	858B	02H	1	73	76	7.93	SLCY	weak	3.3	53.70	0.90	14.70	7.40	ND	ND	0.11
139	858B	02H	2	89	91	9.59	SLCY	non	38.1	54.80	0.81	16.40	7.60	ND	ND	0.09
139	858B	02H	2	121	124	9.91	SILT	moderate	0.0	54.50	0.73	15.40	7.60	ND	ND	0.08
139	858B	02H	2	125	127	9.95	SILT	moderate	ND	59.16	0.83	17.11	8.92	ND	ND	0.10
139	858B	02H	3	50	52	10.70	SAND	indurated	10.4	5.28	0.02	0.34	42.20	ND	ND	0.13
139	858B	02H	3	84	86	11.04	SLCY	non	28.3	7.67	0.03	0.72	4			

Table 1 (continued).

MgO	CaO	Na ₂ O	Na ₂ OC	K ₂ O	P ₂ O ₅	H ₂ OT	S	CO ₂ T	CO ₂	TOC	Na ₂ OX	N	Total
wt%													
1.53	35.80	0.80	ND	1.57	0.61	1.70	0.04	27.80	ND	ND	ND	ND	99.60
1.67	ND	2.50	ND	2.52	0.20	1.90	0.65	ND	ND	ND	ND	ND	94.10
3.17	3.37	1.93	ND	4.26	0.32	3.22	0.30	2.56	1.69	0.24	ND	0.04	101.28
3.65	2.46	2.60	1.86	3.98	0.22	4.10	0.43	2.00	0.90	0.30	0.74	ND	100.50
1.96	7.56	2.40	2.01	3.00	0.18	2.20	0.80	5.30	4.70	0.20	0.39	ND	100.10
2.97	3.40	2.40	1.87	3.65	0.20	2.90	0.51	2.40	1.70	0.20	0.53	ND	99.90
2.05	26.00	0.90	ND	2.63	0.19	2.30	0.10	21.00	ND	ND	ND	ND	100.40
3.44	4.41	2.60	ND	4.42	0.28	3.30	0.30	3.70	2.60	0.30	ND	ND	99.20
1.56	33.90	0.70	ND	1.82	0.17	1.80	0.07	27.30	ND	ND	ND	ND	100.00
3.55	2.65	2.30	1.55	4.27	0.22	4.30	0.15	2.30	1.30	0.30	0.75	ND	99.80
4.11	3.28	2.50	ND	4.14	0.26	4.00	0.22	3.20	1.70	0.40	ND	ND	101.00
4.65	2.33	1.44	ND	4.39	0.23	3.40	1.30	2.45	1.28	0.32	ND	0.04	100.11
3.16	2.78	2.40	1.67	3.80	0.20	3.70	0.27	2.40	1.30	0.30	0.73	ND	99.20
3.65	2.42	2.30	ND	4.11	0.21	3.70	0.60	2.60	1.10	0.40	ND	ND	99.70
2.35	3.50	2.40	1.83	3.59	0.20	3.00	0.18	2.60	2.00	0.20	0.57	ND	99.50
3.01	1.98	2.10	1.44	3.89	0.20	3.50	0.26	1.80	1.00	0.20	0.66	ND	98.90
1.75	5.19	2.60	ND	3.17	0.15	2.20	0.19	3.80	3.20	0.20	ND	ND	99.90
1.71	5.23	2.60	2.20	3.08	0.16	2.00	0.23	3.50	3.10	0.10	0.40	ND	99.50
3.02	3.45	1.62	ND	3.66	0.19	3.49	0.00	2.49	1.90	0.16	ND	0.04	99.86
4.11	2.83	2.30	ND	3.85	0.24	4.20	0.15	2.70	1.50	0.30	ND	ND	100.00
2.72	3.09	2.30	1.81	3.59	0.20	2.80	0.12	2.30	1.70	0.20	0.49	ND	99.70
2.22	3.57	2.50	2.04	3.27	0.17	2.80	0.16	2.30	1.90	0.10	0.46	ND	99.50
2.76	4.46	2.60	ND	3.30	0.20	2.90	0.20	3.10	2.40	0.20	ND	ND	99.10
4.37	6.05	2.53	ND	2.00	0.26	2.50	0.00	12.49	9.52	0.81	ND	0.02	100.89
3.98	2.39	2.30	1.61	3.75	0.24	3.70	0.14	1.90	1.10	0.20	0.69	ND	100.40
4.22	2.58	2.10	1.26	3.99	0.27	4.40	0.21	2.40	1.20	0.30	0.84	ND	100.60
3.77	2.64	2.60	1.76	3.53	0.23	4.10	0.18	2.40	ND	ND	0.84	ND	100.20
3.22	4.12	2.20	1.67	3.65	0.24	3.80	0.19	3.20	2.40	0.20	0.53	ND	101.00
2.40	11.90	1.70	ND	2.79	0.23	7.50	0.20	9.20	ND	ND	ND	ND	101.10
5.07	2.65	1.49	ND	4.12	0.25	4.20	0.21	2.71	1.58	0.31	ND	0.05	101.07
3.72	3.44	2.10	ND	3.67	0.24	ND	0.14	ND	ND	ND	ND	ND	95.20
4.63	2.66	2.10	1.25	3.65	0.18	4.90	0.14	2.90	1.60	0.40	0.85	ND	99.90
3.37	10.80	1.70	1.09	2.92	0.16	ND	4.73	2.90	1.90	0.30	0.61	ND	91.30
4.22	3.52	2.40	1.78	3.07	0.24	3.90	0.74	2.50	ND	ND	0.62	ND	99.20
1.83	10.27	1.87	ND	2.90	0.19	3.04	0.32	2.86	2.23	0.17	ND	0.02	100.27
3.10	2.19	2.80	2.36	2.74	0.20	3.90	0.25	1.40	0.60	0.20	0.44	ND	100.60
3.40	3.45	2.60	ND	2.83	0.19	4.00	0.25	2.80	1.80	0.30	ND	ND	99.90
4.60	3.11	1.67	ND	3.11	0.19	4.20	0.28	3.11	1.72	0.38	ND	0.03	100.27
2.45	44.90	0.20	ND	0.38	0.24	1.90	0.17	36.20	ND	ND	ND	ND	100.80
4.48	2.01	2.80	2.27	2.50	0.22	4.30	0.72	1.30	0.30	0.30	0.53	ND	100.00
3.60	3.14	3.10	2.71	2.26	0.20	3.50	0.41	2.30	1.60	0.20	0.39	ND	99.40
2.90	3.21	2.74	ND	2.36	0.18	3.13	0.13	1.98	1.43	0.15	ND	0.02	100.29
5.42	2.73	2.90	2.51	1.97	0.21	4.70	0.97	1.60	0.50	0.30	0.39	ND	99.20
6.47	6.97	2.70	ND	1.69	0.17	5.20	0.80	1.60	0.10	0.40	ND	ND	99.80
7.37	2.54	2.90	2.35	1.47	0.19	ND	3.67	0.90	0.00	0.20	0.55	ND	96.50
6.00	1.94	2.70	2.24	2.05	0.22	ND	1.45	1.00	0.00	0.30	0.46	ND	91.80
7.82	1.20	3.00	2.46	1.55	0.21	5.70	0.34	0.90	0.00	0.20	0.54	ND	99.90
7.87	1.09	2.74	ND	1.46	0.22	4.65	0.34	0.77	0.07	0.19	ND	0.02	99.80
7.84	0.47	3.00	2.49	1.58	0.20	5.90	0.08	1.00	0.00	0.30	0.51	ND	101.00
7.26	0.46	2.90	ND	1.78	0.21	5.40	0.14	1.00	0.00	0.30	ND	ND	100.90
7.03	0.51	2.70	ND	1.93	0.21	5.40	0.22	0.90	0.00	0.20	ND	ND	100.50
5.23	2.86	3.20	2.81	1.10	0.16	ND	1.68	0.50	0.00	0.10	0.39	ND	94.90
7.36	1.28	2.60	2.18	1.73	0.21	5.50	0.60	1.10	0.00	0.30	0.42	ND	99.10
7.56	0.69	2.60	2.21	1.88	0.21	5.40	0.21	0.80	0.00	0.20	0.39	ND	100.50
6.39	1.12	3.20	2.73	1.48	0.24	4.80	0.57	0.70	0.00	0.20	0.47	ND	100.10
4.53	1.25	3.70	ND	1.00	0.21	3.50	0.76	0.50	0.00	0.10	ND	ND	100.00
4.92	0.60	4.70	4.35	0.65	0.23	ND	1.65	0.60	0.00	0.20	0.35	ND	98.00
7.73	0.72	3.90	3.39	0.97	0.21	5.20	0.33	0.90	0.00	0.20	0.51	ND	99.80
6.13	1.40	3.30	2.96	1.66	0.16	4.60	0.66	1.10	0.00	0.30	0.34	ND	99.10
6.65	0.93	4.00	3.74	1.31	0.19	4.90	0.43	1.00	0.00	0.30	0.26	ND	100.10
4.82	1.87	4.20	3.92	1.40	0.22	4.30	0.33	1.40	0.20	0.30	0.28	ND	100.60
4.90	2.69	4.10	3.71	1.50	0.22	ND	1.24	2.10	1.00	0.30	0.39	ND	98.00
3.91	2.23	4.90	4.62	0.61	0.20	ND	1.44	0.60	0.00	0.20	0.28	ND	97.00
4.17	4.31	3.80	3.58	0.90	0.18	ND	2.28	1.10	0.10	0.30	0.22	ND	96.00
3.72	7.74	4.00	ND	0.43	0.13	ND	4.73	0.10	ND	ND	ND	ND	92.80
6.72	1.37	4.10	3.86	1.18	0.23	ND	1.39	1.00	0.00	0.30	0.24	ND	97.50
6.44	1.38	4.30	4.04	1.15	0.23	4.60	0.32	0.90	0.00	0.20	0.26	ND	100.00
6.36	1.33	3.90	3.67	1.63	0.23	ND	1.25	0.90	0.00	0.20	0.23	ND	97.30
5.02	2.23	3.60	ND	0.14	0.18	3.70	0.24	0.50	0.00	0.10	ND	ND	100.10
17.90	1.85	4.60	ND	0.96	0.06	ND	2.17	ND	ND	ND	ND	ND	86.50
22.39	2.64	1.47	ND	0.69	0.09	ND	2.83	4.62	1.79	0.77	ND	0.1	98.00
3.96	6.45	4.00	ND	2.13	0.17	ND	2.53	6.60	3.10	1.00	ND	ND	97.30
3.71	3.61	1.87	ND	3.22	0.24	5.00	0.53	3.26	1.39	0.51	ND	0.04	99.57
4.63	3.19	3.60	2.23	2.10	0.22	ND	2.55	2.80	1.30	0.40	1.37	ND	97.10
5.82	3.54	3.20	1.89	2.29	0.19	5.60	0.53	4.10	2.80	0.40	1.31	ND	100.00
6.49	2.25	1.97	ND	2.95	0.22	5.54	0.79	3.30	2.34	0.26	ND	0.03	101.13
5.32	1.53	3.20	2.46	2.57	0.20	ND	2.08	0.90	0.00	0.20	0.74	ND	95.70
8.50	1.10	3.10	1.89	2.30	0.24	ND	2.10	0.90	0.00	0.20	1.21	ND	95.20
6.26	1.64	3.50	2.41	2.49	0.20	ND	1.14	0.70	0.00	0.20	1.09	ND	95.80
7.46	1.21	3.10	1.70	2.34	0.17	5.40	0.92	0.90	0.00	0.20	1.40	ND	100.00
8.85	1.20	1.97	ND	2.47	0.18	5.00	0.89	ND	ND	ND	ND	0.03	100.79
6.37	6.62	0.25	ND	0.09	0.04	ND	33.00	9.80	8.80	0.30	0.31	ND	108.00
6.81	0.35	0.74	ND	0.21	0.04	ND	31.50	6.80	4.80	0.50	0.89	ND	106.10
6.62	28.20	0.45	0.11	0.18	0.22	ND	17.60	0.20	ND	ND	0.34	ND	76.20
8.78	3.01	0.65	ND	0.14	0.07	ND	31.20	0.80	0.10	0.20	0.65	ND	104.40
5.79	19.20	0.64	ND	0.17	0.22	ND	25.10	0.50	0.00	0.10	0.75	ND	85.10
8.89	1.13	1.12	ND	0.64	0.15	ND	12.00	0.60	0.00	0.20	0.92	ND	98.60
5.14	0.78	1.49	ND	1.58	0.15	3.49	1.74	0.70	0.29	0.11	ND	0.02	101.04

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Lithology	Induration	Moisture	SiO ₂	TiO ₂	Al ₂ O ₃	Fe ₂ O ₃ T	Fe ₂ O ₃	FeO	MnO
									wt%							
139	858C	12X	2	80	82	66.30	SLCS	indurated	28.4	57.10	0.84	15.80	7.50	0.20	6.80	0.16
139	858C	12X	3	87	90	67.87	SNST	indurated	ND	63.09	0.98	16.19	7.38	ND	ND	0.14
139	858C	12X	CC	8	10	68.14	SNSL	indurated	15.5	69.20	0.75	13.30	3.70	ND	ND	0.06
139	858C	13X	1	1	16	73.71	SNSL	indurated	ND	61.84	0.95	15.96	7.71	ND	ND	0.15
139	858C	13X	1	25	28	73.95	SLCS	indurated	24.4	58.40	0.86	15.70	7.30	0.20	6.40	0.15
139	858C	14X	1	34	36	83.74	SNSL	indurated	ND	61.72	0.96	17.25	8.42	ND	ND	0.14
139	858C	14X	1	49	51	83.87	SLCS	indurated	ND	59.10	0.84	16.10	7.30	ND	ND	0.12
139	858D	01H	1	105	107	1.05	SILT	weak	ND	47.10	0.69	14.00	6.90	ND	ND	0.15
139	858D	01H	1	115	119	1.15	SLCY	non	46.4	50.90	0.79	15.10	7.30	ND	ND	0.11
139	858D	01H	3	27	31	3.27	SLCY	non	42.6	55.70	0.90	15.50	7.50	ND	ND	0.07
139	858D	01H	3	98	102	3.98	SLCY	weak	ND	59.71	1.01	17.44	8.28	ND	ND	0.09
139	858D	01H	3	112	115	4.12	SILT	weak	3.5	55.20	0.83	16.00	7.00	2.60	4.00	0.09
139	858D	01H	4	80	83	5.30	SLCY	weak	5.3	51.20	0.78	14.80	7.10	2.40	4.20	0.11
139	858D	01H	5	84	88	6.84	SLCY	weak	38.6	54.40	0.94	14.90	7.10	2.40	4.20	0.11
139	858D	01H	5	106	110	7.06	SILT	weak	1.8	55.50	0.89	14.80	6.80	2.50	3.90	0.10
139	858D	01H	6	25	28	7.75	SILT	weak	ND	52.10	0.77	15.70	6.70	2.10	4.10	0.12
139	858D	01H	6	30	33	7.80	SLCY	weak	ND	58.74	0.91	17.97	8.25	ND	ND	0.12
139	858D	02H	1	115	117	10.45	SLCY	weak	46.2	49.10	0.66	14.40	6.40	1.50	4.40	0.08
139	858D	02H	1	128	131	10.58	SLCY	weak	1.8	47.90	0.65	14.20	6.00	0.90	4.60	0.09
139	858D	02H	2	76	78	11.56	SLCY	weak	47.1	55.00	0.76	15.30	7.30	ND	ND	0.07
139	858D	02H	2	95	98	11.75	SILT	weak	ND	53.70	0.78	15.40	7.00	1.30	5.10	0.07
139	858D	02H	2	111	113	11.91	SLCY	weak	ND	59.48	0.91	17.03	9.46	ND	ND	0.09
139	858D	02H	3	34	36	12.64	SLCY	weak	38.8	57.20	0.84	15.80	6.60	1.00	5.00	0.07
139	858D	02H	3	133	136	13.63	SLCY	weak	ND	53.70	0.78	15.90	7.80	2.10	5.10	0.08
139	858D	02H	4	46	48	14.26	SLCY	weak	36.6	55.20	0.84	16.60	7.70	1.60	5.50	0.07
139	858D	02H	4	57	60	14.37	SLCY	indurated	ND	53.40	0.79	16.20	7.80	1.80	5.40	0.08
139	858D	02H	5	36	39	15.66	SLCY	indurated	ND	55.10	0.83	16.40	7.60	0.90	6.00	0.08
139	858D	02H	5	53	55	15.83	SLCY	moderate	41.9	53.20	0.88	16.60	7.90	1.30	5.90	0.08
139	858D	02H	6	36	38	17.16	SLCY	moderate	36.6	54.50	0.80	16.50	8.30	ND	ND	0.12
139	858D	02H	6	93	96	17.73	SILT	moderate	ND	49.30	0.73	14.80	7.80	ND	ND	0.18
139	858D	02H	7	14	16	18.44	SLCY	indurated	1.8	54.40	0.70	14.50	9.60	ND	ND	0.12
139	858D	02H	7	23	25	18.53	SLCY	moderate	ND	60.81	0.82	15.96	9.39	ND	ND	0.11
139	858D	02H	CC	10	12	18.92	SLCY	weak	27.1	52.90	0.72	13.50	10.80	ND	ND	0.10
139	858D	04H	3	31	35	21.85	SLCY	slightly	38.8	61.90	0.80	15.70	5.30	ND	ND	0.05
139	858D	04H	3	107	110	22.61	SLCY	indurated	ND	56.60	0.83	17.20	6.50	0.20	5.90	0.08
139	858D	04H	4	59	63	23.63	SILT	indurated	ND	69.32	0.81	15.94	4.55	ND	ND	0.06
139	858D	04H	4	64	67	23.68	SLCY	indurated	1.8	63.10	0.70	14.30	5.40	ND	ND	0.05
139	858D	04H	5	35	33	24.87	SLCU	indurated	1.8	60.50	0.75	15.90	5.20	ND	ND	0.08
139	858D	04H	5	44	48	24.98	SLCY	moderate	29.8	61.50	0.71	15.70	5.30	ND	ND	0.07
139	858D	04H	6	26	29	26.30	SLCY	indurated	1.7	63.70	0.77	14.00	5.40	ND	ND	0.06
139	858D	04H	7	36	40	27.90	SNSL	indurated	27.9	60.70	0.65	13.90	5.80	ND	ND	0.16
139	858F	02R	CC	8	11	27.87	SNSL	indurated	ND	71.50	0.47	9.50	4.10	ND	ND	0.12
139	858F	04R	CC	8	10	46.58	SNST	indurated	ND	75.60	0.48	9.00	3.90	0.20	3.40	0.08
139	858F	08R	CC	11	12	84.81	SNST	indurated	ND	72.00	0.49	12.40	1.80	0.20	1.50	0.03
139	858F	09R	1	18	20	94.38	SNST	indurated	ND	76.53	0.38	13.36	1.59	ND	ND	0.03
139	858F	11R	CC	4	5	114.01	SNST	indurated	ND	66.90	0.48	14.90	2.40	0.20	2.00	0.04
139	858F	12R	CC	2	3	123.32	CLST	moderate	18.9	57.00	0.86	15.80	8.50	0.60	7.10	0.14
139	858F	13R	CC	6	7	132.96	CLST	moderate	9.8	31.10	0.53	7.98	34.20	ND	ND	0.06
139	858F	13R	1	7	9	132.97	SLST	indurated	ND	66.83	0.80	14.15	5.48	ND	ND	0.08
139	858F	14R	1	10	12	142.70	SLST	indurated	3.8	60.30	0.77	15.10	5.80	ND	ND	0.09
139	858F	15R	1	4	6	152.24	SNST	indurated	ND	62.60	0.56	14.70	3.80	ND	ND	0.05
139	858F	17R	1	16	18	171.76	STSS	indurated	ND	69.60	0.46	14.40	1.90	ND	ND	0.02
139	858F	18R	1	14	16	181.44	SLST	indurated	1.7	65.60	0.63	13.50	6.00	0.40	5.00	0.08
139	858F	21R	1	14	16	210.44	CLST	indurated	2.0	55.50	0.89	16.50	8.40	0.20	7.60	0.15
139	858F	23R	1	3	5	229.63	SNST	indurated	ND	70.30	0.57	13.40	3.10	ND	ND	0.06
139	858F	25R	1	9	11	248.99	CLST	indurated	1.7	57.80	0.92	16.30	6.60	ND	ND	0.13
139	858F	25R	1	19	21	249.09	CLST	indurated	ND	55.50	0.90	16.90	7.10	0.40	6.00	0.15
139	858F	25R	1	40	42	249.30	CLST	indurated	ND	55.37	1.10	18.53	8.29	ND	ND	0.17
139	858F	25R	1	61	63	249.51	SLST	indurated	ND	55.60	0.86	14.70	10.20	ND	ND	0.12
139	858F	25R	1	71	73	249.61	CLST	indurated	1.8	52.80	0.92	16.70	8.50	ND	ND	0.16

Table 1 (continued).

MgO	CaO	Na ₂ O	Na ₂ OC	K ₂ O	P ₂ O ₅	H ₂ O ^T	S	CO ₂ T	CO ₂	TOC	Na ₂ OX	N	Total
wt%													
7.67	0.94	3.80	ND	0.09	0.26	5.30	0.51	0.90	0.00	0.20	ND	ND	100.20
7.46	1.29	3.60	ND	0.09	0.24	4.29	0.79	0.81	0.04	0.21	ND	0	100.46
3.15	1.37	2.50	2.03	0.75	0.19	ND	1.10	0.30	0.00	0.10	0.47	ND	96.50
6.39	2.73	3.75	ND	0.05	0.31	3.31	0.39	0.88	0.04	0.23	ND	0.01	99.84
5.83	2.48	4.20	3.67	0.06	0.20	3.90	0.24	1.00	0.00	0.30	0.53	ND	99.70
5.70	2.39	3.49	ND	0.69	0.02	3.49	0.50	0.99	0.07	0.25	ND	0.02	100.78
4.70	2.49	4.20	ND	0.51	0.21	3.50	0.50	0.90	0.00	0.00	ND	ND	100.60
3.19	8.80	3.80	ND	1.97	0.17	ND	1.27	8.00	4.70	0.90	ND	ND	96.20
3.24	5.66	3.60	ND	2.49	0.19	ND	1.34	4.70	2.50	0.60	ND	ND	95.60
2.62	3.80	3.20	ND	2.72	0.20	ND	1.01	2.10	1.30	0.20	ND	ND	95.50
3.34	4.60	1.66	ND	3.04	0.22	4.74	0.21	4.36	2.05	0.63	ND	0.04	99.39
3.23	4.52	3.40	ND	2.16	0.24	4.90	0.14	3.10	ND	ND	ND	ND	100.50
3.36	7.26	3.60	ND	2.04	0.21	4.80	0.19	4.50	3.40	0.30	ND	ND	99.80
3.44	5.28	3.50	ND	2.01	0.24	4.70	0.22	3.20	2.10	0.30	ND	ND	99.60
3.37	5.46	3.40	ND	1.95	0.23	4.60	0.15	3.10	1.90	0.30	ND	ND	100.10
3.47	6.81	3.50	ND	2.40	0.21	4.60	0.07	4.70	3.50	0.30	ND	ND	100.90
4.03	5.30	2.58	ND	2.83	0.23	4.74	0.42	3.52	2.23	0.35	ND	0.04	100.96
4.96	5.67	2.90	ND	2.90	0.14	6.20	0.50	6.60	5.20	0.40	ND	ND	100.20
5.35	6.07	2.70	ND	2.89	0.15	5.70	0.40	8.00	6.30	0.50	ND	ND	99.70
3.78	2.98	3.00	ND	2.99	0.17	ND	1.00	3.20	1.60	0.40	ND	ND	95.70
3.95	3.27	2.90	ND	2.84	0.18	5.90	0.72	3.60	1.60	0.50	ND	ND	99.90
4.91	2.66	1.80	ND	3.09	0.19	5.45	0.53	3.04	1.69	0.37	ND	0.04	99.62
3.55	1.95	3.00	ND	2.66	0.20	5.90	0.87	1.80	0.60	0.30	ND	ND	100.10
4.29	2.17	2.60	ND	2.97	0.20	6.50	0.71	3.20	1.20	0.50	ND	ND	100.50
4.40	1.33	2.60	ND	2.97	0.20	6.30	0.46	1.90	0.10	0.50	ND	ND	100.10
4.39	2.40	2.50	ND	3.05	0.20	6.30	0.60	3.00	1.00	0.50	ND	ND	100.30
5.25	1.19	2.40	ND	3.54	0.21	5.80	0.54	1.70	0.40	0.40	ND	ND	100.10
5.52	0.96	2.60	ND	3.67	0.22	6.10	0.62	1.40	0.00	0.40	ND	ND	99.30
4.66	0.82	2.60	ND	3.54	0.17	ND	2.70	1.10	0.00	0.30	ND	ND	96.00
7.21	3.99	2.00	ND	3.09	0.17	ND	3.00	3.60	2.40	0.30	ND	ND	96.00
5.22	0.71	2.10	ND	3.60	0.15	ND	4.84	1.80	0.00	0.50	ND	ND	98.10
7.05	0.58	1.16	ND	3.61	0.16	4.56	2.86	1.58	0.04	0.42	ND	0.05	99.65
4.05	0.84	2.04	ND	3.39	0.17	ND	5.82	1.10	0.00	0.30	ND	ND	95.80
4.26	0.75	2.00	ND	2.93	0.19	5.10	0.57	1.30	0.00	0.40	ND	ND	101.00
5.42	0.78	1.50	ND	3.30	0.21	5.70	0.61	1.20	0.00	0.30	ND	ND	99.40
5.51	0.44	0.29	ND	3.27	0.21	4.20	0.30	0.95	0.04	0.25	ND	0.04	100.40
4.45	0.76	1.20	ND	3.05	0.19	ND	1.53	1.00	0.00	0.30	ND	ND	95.90
5.87	0.62	0.90	ND	3.41	0.19	5.40	0.46	0.90	0.00	0.20	ND	ND	100.30
5.41	0.52	0.80	ND	3.43	0.17	5.20	0.80	0.80	0.00	0.20	ND	ND	100.50
5.37	0.97	0.80	ND	3.04	0.16	ND	1.87	1.00	0.00	0.30	ND	ND	97.30
7.60	1.09	0.60	ND	2.13	0.14	ND	1.15	1.00	0.00	0.30	ND	ND	95.00
6.75	1.89	0.30	ND	0.07	0.08	4.80	0.06	0.70	0.00	0.20	ND	ND	100.40
4.52	2.42	0.30	ND	0.09	0.13	4.30	0.02	0.10	ND	ND	ND	ND	100.60
0.98	6.60	0.40	ND	0.05	0.13	4.20	0.02	0.30	0.00	0.10	ND	ND	99.20
0.29	7.15	0.00	ND	0.00	0.08	4.56	0.00	0.29	ND	ND	ND	0.01	99.41
1.86	7.08	0.70	ND	0.05	0.10	5.20	0.04	0.20	ND	ND	ND	ND	99.80
7.04	2.64	3.40	ND	0.07	0.24	4.60	0.12	0.40	0.00	0.10	ND	ND	100.10
3.38	1.25	2.05	ND	0.22	0.16	ND	25.00	0.40	0.00	0.10	ND	ND	106.40
5.06	2.95	3.23	ND	0.05	0.18	ND	ND	ND	0.00	0.00	ND	ND	98.81
6.20	1.95	4.10	ND	0.19	0.21	ND	1.13	0.20	ND	ND	ND	ND	96.10
3.11	6.15	0.70	ND	0.29	0.15	ND	1.20	0.20	ND	ND	ND	ND	93.60
1.31	4.91	2.70	ND	0.07	0.14	3.70	0.46	0.20	ND	ND	ND	ND	99.90
4.65	1.94	3.70	ND	0.06	0.18	3.50	0.02	0.20	ND	ND	ND	ND	99.60
6.92	1.38	3.80	ND	0.80	0.22	4.50	0.83	0.90	ND	ND	ND	ND	100.00
1.80	4.00	3.90	ND	0.05	0.16	2.10	0.25	0.20	ND	ND	ND	ND	100.00
6.52	1.74	4.60	ND	0.61	0.22	4.20	0.32	0.60	0.00	0.20	ND	ND	100.70
7.45	1.62	4.20	ND	0.77	0.19	4.70	0.09	0.80	0.00	0.20	ND	ND	99.80
9.38	1.90	4.45	ND	0.54	0.26	ND	ND	ND	ND	ND	ND	ND	99.99
5.85	1.95	4.60	ND	0.10	0.21	ND	4.01	0.60	0.00	0.20	ND	ND	98.90
8.54	1.66	4.50	ND	0.30	0.24	ND	1.12	0.80	0.00	0.20	ND	ND	96.30

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Ba	Ag	Be	Ce	Co	Cr	Cu	La	Nb
									parts per million						
139	855A	01R	2	77	79	2.27	590	ND	1.7	ND	22	92	45	24	10
139	855A	01R	4	70	74	5.20	700	ND	1.3	ND	27	73	54	17	13
139	855A	01R	4	111	114	5.61	784	ND	ND	5	ND	81	58	ND	9
139	855A	02R	1	71	73	8.31	860	ND	1.5	ND	29	88	73	19	10
139	855A	02R	3	43	45	11.02	847	ND	ND	51	ND	105	44	ND	17
139	855A	02R	3	69	71	11.29	740	ND	1.8	ND	25	78	53	26	11
139	855A	03R	2	80	82	18.90	746	ND	ND	9	ND	103	62	ND	9
139	855A	04R	1	112	115	27.12	750	ND	1.3	ND	24	73	63	15	11
139	855A	04R	3	96	98	29.96	710	ND	1.3	ND	21	74	45	16	10
139	855A	04R	4	81	83	31.31	520	ND	1.3	ND	22	89	43	17	10
139	855A	05R	1	4	6	35.54	620	ND	1.2	ND	26	75	59	15	13
139	855A	06R	1	100	104	46.50	540	ND	1.2	ND	22	78	44	15	11
139	855A	07R	3	65	67	58.75	770	ND	1.3	ND	16	53	44	15	10
139	855B	02R	1	106	110	6.76	840	ND	1.5	ND	29	76	63	19	10
139	855B	04R	1	128	132	25.78	610	ND	1.3	ND	29	84	56	16	10
139	855B	04R	3	122	126	28.72	590	ND	1.3	ND	23	82	49	18	10
139	855B	04R	4	57	61	29.57	490	ND	1.1	ND	22	77	24	16	12
139	855B	04R	4	99	102	29.99	568	ND	ND	8	ND	95	36	ND	10
139	855B	04R	5	118	122	31.68	840	ND	1.3	ND	19	76	54	18	10
139	855B	05R	1	25	28	34.25	507	ND	ND	12	ND	78	26	ND	9
139	855C	01R	1	57	61	0.57	710	ND	1.7	ND	23	69	44	22	11
139	855C	01R	3	55	57	3.55	670	ND	1.4	ND	24	77	50	19	10
139	855C	01R	5	56	58	6.56	770	ND	1.3	ND	23	68	49	17	10
139	855C	02R	1	53	57	9.23	740	ND	1.3	ND	28	86	60	17	10
139	855C	02R	3	54	58	12.24	760	ND	1.7	ND	28	90	56	23	10
139	855C	02R	5	52	56	15.22	1300	ND	1.5	ND	25	80	57	20	10
139	855C	03R	1	45	47	18.15	860	ND	1.4	ND	29	78	64	16	10
139	855C	04R	1	87	89	27.97	850	ND	1.4	ND	28	86	60	19	13
139	855C	04R	3	103	105	31.13	640	ND	1.3	ND	26	73	58	15	11
139	855C	06R	1	128	132	47.78	600	ND	1.3	ND	24	91	48	18	11
139	855C	06R	2	2	6	48.02	70	ND	0.7	ND	49	160	110	ND	10
139	855C	06R	3	130	134	50.80	590	ND	1.2	ND	23	81	45	16	ND
139	855C	06R	5	76	80	53.26	616	ND	ND	2	ND	86	50	ND	9
139	855C	07R	1	76	80	56.86	793	ND	ND	4	ND	105	75	ND	9
139	855C	07R	2	83	87	58.43	580	ND	1.3	ND	22	88	57	14	ND
139	855C	07R	4	80	84	61.40	630	ND	1.2	ND	19	72	38	16	ND
139	855C	07R	6	60	64	64.20	470	ND	1.2	ND	24	76	61	13	13
139	855C	08R	2	33	36	66.78	593	ND	ND	5	ND	87	46	ND	9
139	855C	08R	2	40	44	66.85	590	ND	1.3	ND	23	75	44	15	10
139	855C	10R	1	130	134	86.20	550	ND	1.5	ND	25	84	54	17	12
139	855C	10R	4	51	55	88.41	950	ND	1.1	ND	19	68	30	17	10
139	855C	10R	5	43	47	89.83	524	ND	ND	3	ND	87	54	ND	9
139	855C	11R	1	67	70	95.27	456	ND	ND	7	ND	76	28	ND	7
139	855C	11R	1	115	119	95.75	410	ND	0.9	ND	17	73	25	15	10
139	856A	01H	1	69	72	0.69	934	ND	ND	2	ND	82	59	ND	10
139	856A	01H	1	95	98	0.95	870	1	1.4	ND	28	78	69	18	5
139	856A	02H	1	45	47	3.15	570	1	1.4	ND	28	86	62	19	10
139	856A	02H	2	62	64	4.82	740	ND	ND	20	ND	96	66	ND	11
139	856A	03H	1	107	111	13.27	590	1	1.7	ND	24	92	38	28	18
139	856A	03H	2	67	71	14.37	730	ND	ND	26	ND	109	45	ND	14
139	856A	03H	5	117	121	19.37	480	1	1.4	ND	25	78	45	19	15
139	856A	03H	6	8	9	19.78	240	1	1.1	ND	10	42	33	18	ND
139	856A	03H	7	1	16	21.32	660	1	1.6	ND	23	98	43	22	14
139	856A	04H	2	37	41	23.57	600	1	1.5	ND	20	90	33	24	14
139	856A	04H	2	86	90	24.06	762	ND	ND	23	ND	103	47	ND	14
139	856A	04H	4	36	40	26.56	600	1	1.2	ND	20	89	32	20	11
139	856A	04H	6	55	59	29.75	520	1	1.1	ND	19	110	29	25	11
139	856A	05H	2	73	77	32.31	580	1	1.1	ND	17	88	22	19	11
139	856A	05H	3	73	77	33.81	711	ND	ND	17	ND	112	37	ND	12
139	856A	05H	4	91	95	35.49	540	1	1.4	ND	25	90	54	18	5
139	856A	05H	5	29	31	36.37	700	1	1.3	ND	19	78	42	19	11
139	856A	05H	8	71	75	41.29	650	1	1.2	ND	20	87	30	18	11
139	856A	06H	1	79	84	41.49	610	1	1.2	ND	17	93	31	20	10
139	856A	06H	2	88	92	43.08	581	ND	ND	7	ND	96	26	ND	9
139	856A	06H	2	144	148	43.64	680	1	1.5	ND	30	81	75	18	15
139	856A	06H	3	103	107	44.73	580	1	1.5	ND	18	82	34	27	11
139	856A	06H	4	69	77	45.89	560	1	0.9	ND	12	83	41	19	5
139	856A	06H	4	89	94	46.09	490	1	1.0	ND	17	89	32	19	13
139	856A	06H	5	104	106	47.74	560	1	1.5	ND	21	91	97	19	15
139	856A	06H	6	90	94	49.10	530	1	0.9	ND	17	86	35	17	10
139	856A	06H	7	61	65	50.31	660	1	1.1	ND	20	110	38	17	10
139	856A	07H	1	89	93	51.09	610	1	1.5	ND	21	89	150	19	10
139	856A	07H	2	95	99	52.65	488	ND	ND	12	ND	80	24	ND	9
139	856A	07H	3	0	3	53.20	ND	1.1	20.0	ND	74	38	15	15	42
139	856A	07H	3	81	85	54.01	610	1	1.4	ND	24	78	57	15	12
139	856A	07H	5	70	74	56.90	580	1	1.3	ND	28	89	42	14	17
139	856A	07H	6	139	142	59.09	500	1	1.0	ND	19	78	50	17	5
139	856A	07H	7	55	59	59.75	530	1	1.3	ND	27	85	47	17	5
139	856A	07H	CC	24	28	60.20	ND	0.7	2.5	ND	34	16	5	10	22
139	856A	08H	1	4	6	59.74	160	1	0.8	ND	5	38	11	5	11
139	856A	08H	1	8	10	59.78	330	1	1.0	ND	17	71	24	17	5
139	856A	08H	1	97	99	60.67	570	1	1.3	ND	27	96	44	16	5
139	856A	08H	3	23	26	62.93	460	1	1.0	ND	19	82	30	17	5
139	856A	08H	3	66	68	63.36	569	ND	ND	9	ND	114	57	ND	9
139	856A	08H	3	72	75	63.42	530	1	1.3	ND	25	89	44	16	14
139	856A	08H	5	84	87	66.54	540	1	1.3	ND	26	96	52	15	5
139	856A	08H	7	26	28	68.96	540	1	1.3	ND	26	97	48	18	5
139	856A	09H	1	4	47	69.64	410	1	1.1	ND	18	58	27	32	14
139	856A	09H	1	10	13	69.30	610	1	1.4	ND	23	80	43	17	5

Table 1 (continued).

Ni	Pb	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As	Mo
parts per million													
48	53	87	17	330	130	23	2.20	420	140	0.66	0.89	8.4	43
60	20	65	18	370	130	20	1.80	110	120	0.81	0.64	9.4	1
48	ND	69	ND	343	171	21	ND	120	144	ND	ND	ND	ND
65	20	78	18	350	140	22	2.00	120	120	0.64	0.91	5.1	1
53	ND	157	ND	222	128	21	ND	105	141	ND	ND	ND	ND
59	24	110	18	300	130	21	2.00	110	120	0.49	0.75	5.0	1
69	ND	67	ND	272	183	23	ND	133	144	ND	ND	ND	ND
57	20	70	17	370	140	18	1.60	120	99	1.44	0.67	7.0	1
57	20	60	15	480	120	19	1.80	100	95	1.77	0.63	4.6	1
59	20	51	19	310	140	21	2.10	95	110	0.53	0.39	5.8	1
55	26	57	19	350	150	20	1.90	120	110	0.75	0.60	4.8	1
49	20	52	18	350	130	21	2.00	85	130	0.50	0.59	7.1	1
55	20	64	13	330	100	17	1.60	110	120	1.01	1.09	4.5	1
76	20	73	16	430	130	20	1.90	140	100	0.91	1.31	3.9	1
73	20	52	18	360	130	20	2.00	110	120	0.59	0.50	7.2	1
74	20	60	18	360	140	20	2.00	110	130	0.79	0.75	5.2	1
55	20	37	15	430	100	18	1.90	65	160	ND	ND	ND	1
48	ND	50	ND	354	147	22	ND	76	201	ND	ND	ND	ND
55	21	63	16	480	120	20	2.00	110	100	0.92	0.51	3.5	1
36	ND	38	ND	386	146	23	ND	55	217	ND	ND	ND	ND
48	27	86	16	370	120	21	2.10	99	130	1.45	0.90	5.4	1
54	20	70	16	410	130	20	2.00	100	130	0.73	0.90	4.8	1
49	21	60	16	430	130	19	1.80	110	110	0.79	0.62	6.0	1
73	21	62	18	350	140	20	1.90	110	110	1.04	1.01	4.2	1
72	24	91	18	310	140	20	1.90	120	120	0.89	1.03	5.8	1
64	24	78	17	310	140	20	1.90	130	120	2.09	1.11	4.2	1
74	22	70	17	320	150	18	1.60	120	91	2.76	1.16	4.8	1
67	21	73	18	340	140	21	2.00	110	120	1.04	0.71	6.2	1
53	ND	62	19	360	150	18	1.70	110	83	0.90	0.61	4.9	1
62	39	55	18	330	130	20	1.90	98	120	0.52	0.38	5.4	1
110	ND	ND	35	140	290	39	3.80	92	120	0.10	0.46	13.9	1
53	ND	58	18	360	130	20	1.90	100	130	0.58	0.39	5.3	1
48	ND	57	ND	317	157	22	ND	101	161	ND	ND	ND	ND
55	ND	69	ND	236	194	24	ND	132	141	ND	ND	ND	ND
59	21	67	19	290	140	19	1.70	110	110	0.89	0.47	5.5	1
45	ND	55	16	410	110	18	1.70	85	120	0.57	0.26	6.2	1
46	ND	58	20	300	150	20	1.80	92	110	0.42	0.39	10.3	1
42	ND	57	ND	327	168	23	ND	100	169	ND	ND	ND	ND
51	ND	62	18	340	130	20	1.80	91	120	ND	ND	ND	ND
59	20	77	19	280	150	19	1.90	110	110	0.62	0.42	5.3	1
38	20	44	16	420	110	19	1.90	68	160	0.28	0.32	6.3	1
45	ND	63	ND	246	199	24	ND	110	142	ND	ND	ND	ND
28	ND	34	ND	347	145	22	ND	49	199	ND	ND	ND	ND
31	20	31	17	390	130	19	2.00	53	210	0.10	0.27	7.7	1
62	ND	73	ND	416	156	22	ND	129	165	ND	ND	ND	ND
70	22	71	15	480	120	20	1.90	140	100	1.03	1.19	7.3	1
63	23	70	18	340	140	23	2.20	120	120	0.68	0.71	4.8	1
59	ND	86	ND	252	162	24	ND	156	152	ND	ND	ND	ND
63	23	88	15	320	120	22	2.10	100	170	0.70	0.50	9.2	1
49	ND	91	ND	295	151	25	ND	112	217	ND	ND	ND	ND
67	10	66	17	290	130	20	1.90	110	140	1.70	1.00	8.7	2
38	10	ND	10	220	68	25	1.90	63	63	1.96	0.51	2.6	1
68	10	75	16	320	120	20	1.90	110	140	0.50	0.49	5.7	1
54	23	68	14	330	100	19	1.80	83	160	ND	ND	ND	ND
61	ND	99	ND	240	152	24	ND	118	164	ND	ND	ND	ND
52	10	64	14	420	99	18	1.70	76	160	ND	ND	ND	ND
46	10	43	14	460	110	21	2.20	66	270	0.22	0.39	4.6	1
46	10	50	12	400	89	16	1.70	80	190	0.26	0.44	4.0	1
61	ND	76	ND	259	138	22	ND	99	180	ND	ND	ND	ND
58	10	74	18	250	140	21	2.00	130	140	0.68	0.44	7.6	1
47	10	69	16	260	120	20	1.90	93	150	0.38	0.34	3.0	1
51	10	58	14	360	100	17	1.80	91	170	0.66	0.58	3.4	1
46	10	54	13	390	99	18	1.70	75	170	0.31	0.35	2.6	1
39	ND	49	ND	350	153	19	ND	69	190	ND	ND	ND	ND
68	10	73	17	300	140	19	1.80	130	110	0.68	0.30	4.1	1
49	10	72	15	360	100	21	1.90	120	170	0.43	0.25	4.4	1
36	10	38	11	340	73	18	1.80	53	170	0.31	0.61	3.8	1
44	10	42	15	320	120	19	1.90	62	180	0.51	0.47	5.3	1
54	10	77	20	220	150	22	1.90	210	130	0.79	0.42	4.2	1
49	10	42	14	340	94	19	1.70	70	170	0.75	0.89	13.3	3
65	10	44	16	270	120	20	1.80	78	150	0.63	0.58	7.3	1
59	10	79	18	260	140	20	1.80	130	120	0.81	0.46	6.0	1
32	ND	42	ND	321	148	24	ND	65	207	ND	ND	ND	ND
10	46	17	360	120	19	1.8	91.00	140	99.9	ND	ND	ND	ND
64	10	73	20	230	150	20	1.70	140	100	0.40	0.10	4.4	1
72	10	59	19	260	150	18	1.60	140	100	0.32	0.10	3.3	1
74	10	44	15	350	100	17	1.70	76	140	0.70	0.87	25.6	3
65	10	52	18	310	140	20	1.90	110	120	0.78	0.36	10.4	1
10	15	7	270	49	9	0.5	57.00	49	100.9	ND	ND	ND	ND
24	10	16	7.7	190	55	13	0.90	60	49	0.25	0.10	2.0	1
44	10	30	13	330	96	23	2.10	87	130	0.31	0.22	4.1	1
73	10	60	19	280	150	20	2.00	110	110	0.32	0.20	6.5	1
46	10	31	14	410	110	17	1.80	70	170	0.55	0.44	7.8	1
68	ND	60	ND	197	189	22	ND	131	135	ND	ND	ND	ND
65	10	53	18	290	140	20	1.90	110	120	0.47	0.22	4.3	1
68	10	56	19	280	140	21	1.90	120	110	0.37	0.25	6.4	1
67	10	50	18	300	140	23	2.00	110	120	0.43	0.42	4.2	1
48	20	40	10	280	66	26	2.30	56	240	ND	ND	ND	ND
57	10	54	16	260	120	19	1.80	100	110	0.56	0.27	5.9	1

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Ba	Ag	Be	Ce	Co	Cr	Cu	La	Nb
									parts per million						
139	856A	09H	1	44	47	ND	410	2	1.1	ND	18	58	27	32	14
139	856A	09H	1	83	87	70.03	570	1	1.3	ND	23	91	49	18	14
139	856A	09H	2	94	98	71.64	582	ND	ND	23	ND	83	44	ND	13
139	856A	09H	3	63	67	72.83	560	1	1.6	ND	19	77	46	23	16
139	856A	09H	4	115	117	74.85	370	1	1.0	ND	23	47	39	24	12
139	856A	09H	5	41	42	75.61	370	1	1.0	ND	10	46	31	28	5
139	856A	09H	5	80	84	76.00	560	1	1.5	ND	25	94	42	22	5
139	856A	09H	7	59	63	78.79	550	1	1.3	ND	20	87	34	16	5
139	856A	10X	1	68	71	79.38	489	ND	ND	12	ND	96	41	ND	9
139	856A	10X	2	119	122	81.39	530	1	1.3	ND	25	69	40	23	12
139	856A	10X	2	128	130	81.48	480	1	1.1	ND	19	68	35	17	5
139	856A	11X	1	70	72	86.90	600	ND	1.1	ND	17	92	29	21	ND
139	856A	11X	1	104	106	87.24	754	ND	ND	ND	ND	88	18	ND	8
139	856A	11X	2	47	48	88.17	650	1	1.3	ND	23	78	43	17	5
139	856A	12X	1	85	89	96.55	691	ND	ND	ND	ND	95	39	ND	10
139	856A	12X	1	92	96	96.62	690	1	1.3	ND	22	79	33	19	14
139	856A	12X	2	20	24	97.40	570	1	1.2	ND	18	86	31	19	12
139	856A	13X	2	13	16	106.93	470	1	1.1	ND	19	69	10	20	12
139	856A	13X	2	12	127	108.03	533	ND	ND	19	ND	90	41	ND	10
139	856A	13X	4	47	51	110.27	280	1	1.1	ND	18	75	17	18	13
139	856B	01H	1	102	106	1.02	570	1	1.3	ND	23	72	52	17	5
139	856B	01H	1	123	127	1.23	801	ND	ND	10	ND	85	49	ND	10
139	856B	02H	2	3	7	3.33	550	1	1.4	ND	18	66	27	22	5
139	856B	02H	3	45	49	5.25	783	ND	ND	15	ND	95	48	ND	11
139	856B	02H	5	115	119	8.95	660	1	1.5	ND	23	82	59	20	5
139	856B	03H	5	23	25	17.53	420	1	1.4	ND	25	83	11	21	12
139	856B	03H	5	110	113	18.40	50	2	0.3	ND	5	5	1000	5	ND
139	856B	03H	5	120	122	18.50	30	4	0.3	ND	250	5	42000	5	ND
139	856B	03H	5	142	144	18.72	110	6	0.3	ND	420	5	60000	5	ND
139	856B	03H	6	34	36	19.14	50	5	0.3	ND	280	5	34000	5	ND
139	856B	03H	7	6	8	20.36	50	6	0.3	ND	250	13	17000	5	ND
139	856B	03H	7	28	30	20.58	100	8	0.3	ND	260	11	16000	5	ND
139	856B	03H	7	32	34	20.62	150	8	0.5	ND	140	27	9200	5	ND
139	856B	03H	CC	28	31	21.33	200	8	0.7	ND	150	46	21000	18	ND
139	856B	04H	1	78	81	21.58	250	10	1.1	ND	150	41	17000	5	ND
139	856B	04H	1	134	136	22.14	120	8	0.7	ND	180	54	22000	5	ND
139	856B	04H	1	145	147	22.25	110	11	0.5	ND	280	48	36000	5	ND
139	856B	04H	2	86	88	23.16	460	2	1.3	ND	54	110	2400	15	15
139	856B	04H	2	130	132	23.60	300	4	1.2	ND	69	82	6400	12	ND
139	856B	04H	3	35	37	24.15	350	7	1.2	ND	140	82	16000	12	ND
139	856B	04H	3	85	87	24.65	1500	1	1.4	ND	27	80	420	17	12
139	856B	04H	4	37	39	25.67	560	1	1.3	ND	27	71	630	13	5
139	856B	04H	4	101	106	26.31	630	1	1.1	ND	19	74	37	18	11
139	856B	04H	6	61	66	28.91	710	1	1.3	ND	28	79	77	13	16
139	856B	05H	2	67	70	32.47	610	1	1.3	ND	24	86	100	16	13
139	856B	05H	2	73	77	32.53	647	ND	ND	6	ND	93	43	ND	9
139	856B	05H	4	51	57	35.31	740	1	1.2	ND	20	84	5	21	15
139	856B	05H	6	92	97	38.72	610	ND	1.1	ND	20	90	56	17	12
139	856B	06H	2	23	29	41.53	630	1	1.2	ND	23	89	61	17	14
139	856B	06H	2	104	108	42.34	680	1	1.2	ND	24	80	50	15	12
139	856B	06H	4	25	29	44.55	750	1	1.2	ND	21	84	45	16	17
139	856B	06H	4	124	128	45.54	490	1	1.3	ND	22	80	55	18	17
139	856B	06H	6	12	16	47.42	560	1	1.3	ND	20	89	18	19	17
139	856B	06H	6	118	122	48.48	530	1	1.3	ND	23	92	43	16	17
139	856B	06H	6	130	132	48.60	759	ND	ND	2	ND	104	157	ND	9
139	856B	07H	3	130	133	53.60	847	ND	ND	13	ND	94	17	ND	12
139	856B	07H	4	88	95	54.68	670	1	1.5	ND	19	66	44	27	22
139	856B	07H	5	26	32	55.56	990	1	1.5	ND	18	79	79	20	16
139	856B	07H	6	141	148	58.21	810	1	1.5	ND	20	88	54	20	17
139	856B	08H	1	34	36	59.14	270	1	0.7	ND	30	54	26	13	0
139	856B	08H	2	55	57	60.85	326	ND	ND	26	ND	95	6	ND	10
139	856B	08H	3	55	57	62.35	330	1	1.5	ND	20	76	5	17	15
139	856B	09X	2	15	19	63.95	270	1	1.4	ND	18	88	46	14	18
139	856B	09X	2	139	142	65.19	232	ND	ND	14	ND	97	51	ND	9
139	856B	10X	2	54	58	72.84	180	1	1.1	ND	17	92	120	28	17
139	856B	11X	1	54	58	73.84	140	1	1.0	ND	14	72	10	12	17
139	856B	11X	3	93	97	77.23	150	1	0.9	ND	16	66	12	17	16
139	856B	11X	5	53	57	79.83	180	1	1.2	ND	15	69	32	17	20
139	856B	12X	2	42	46	83.52	130	1	0.9	ND	6	52	50	13	20
139	856B	12X	2	52	56	83.64	0	ND	ND	ND	ND	ND	ND	ND	ND
139	856B	12X	3	12	16	84.72	80	ND	ND	16	ND	71	5	ND	7
139	856B	12X	4	29	33	86.39	130	1	1.0	ND	14	81	11	16	21
139	856B	12X	CC	18	22	89.30	100	1	0.9	ND	22	58	28	11	19
139	856B	13X	2	63	67	93.23	100	1	1.2	ND	20	67	12	20	19
139	856B	13X	4	109	113	96.69	111	ND	ND	13	ND	83	16	ND	8
139	856B	13X	4	128	132	96.88	150	ND	1.1	ND	19	77	20	14	19
139	856B	14X	1	34	36	101.14	300	1	1.3	ND	30	89	45	21	21
139	856B	14X	3	76	79	104.56	100	1	0.7	ND	43	110	30	17	22
139	856B	14X	4	50	53	105.80	60	1	0.6	ND	17	77	5	18	20
139	856B	15X	1	48	50	110.88	460	2	1.2	ND	21	87	560	20	19
139	856B	15X	1	91	93	111.31	440	3	0.9	ND	21	73	2000	13	5
139	856B	15X	1	124	126	111.64	30	3	0.3	ND	28	57	24000	16	14
139	856B	15X	2	27	29	112.17	510	1	0.7	ND	21	90	67	15	17
139	856B	15X	2	67	69	112.57	570	1	0.3	ND	20	65	14000	18	12
139	856B	15X	2	100	102	112.90	470	1	0.5	ND	17	61	4300	23	11
139	856B	15X	3	8	10	113.48	290	2	0.3	ND	16	56	7600	18	15
139	856B	15X	3	75	77	114.15	530	1	0.5	ND	16	64	8000	21	14
139	856B	15X	3	104	106	114.45	801	ND	ND	ND	ND	160	3516	ND	12

Table 1 (continued).

Ni	Pb	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As	Mo
parts per million													
48	20	40	10	280	66	26	2.30	56	240	1.47	3.10	15.9	2
66	10	60	18	280	140	20	1.90	120	130	0.43	0.27	3.4	1
42	ND	61	ND	228	150	22	ND	89	213	ND	ND	ND	ND
50	24	75	15	240	120	17	1.80	120	190	1.58	0.49	2.2	1
85	36	32	8.4	250	56	20	1.70	89	130	2.68	3.85	21.9	8
31	10	39	9.5	240	64	27	2.00	120	100	0.78	1.00	5.7	2
60	20	64	18	270	140	20	2.00	120	170	0.52	0.98	6.1	1
51	10	49	19	290	140	20	1.80	110	130	0.40	0.93	3.4	1
42	ND	36	ND	324	136	22	ND	53	184	ND	ND	ND	ND
44	10	42	17	300	130	44	2.60	100	100	0.43	0.69	2.3	1
34	10	33	16	450	120	22	1.80	74	150	0.10	0.81	3.9	1
35	ND	40	14	410	92	21	2.00	87	230	0.31	0.46	4.5	1
28	ND	39	ND	386	124	18	ND	34	229	ND	ND	ND	ND
49	10	60	18	260	130	18	1.70	100	130	0.25	0.30	4.8	1
48	ND	51	ND	168	166	20	ND	108	143	ND	ND	ND	ND
47	10	46	17	220	120	23	1.80	110	130	0.54	0.68	9.8	1
44	10	49	17	240	120	21	2.00	77	150	0.21	0.53	5.8	1
38	10	34	16	250	100	18	1.60	81	180	0.10	0.42	6.8	1
56	ND	59	ND	120	176	27	ND	110	128	ND	ND	ND	ND
44	10	32	15	230	110	17	1.60	76	150	0.34	0.43	4.8	1
52	10	63	17	400	130	20	2.00	100	110	0.96	0.58	4.2	1
57	ND	92	ND	338	136	19	ND	117	143	ND	ND	ND	ND
49	10	68	12	380	82	17	1.60	180	140	0.57	0.53	5.1	1
48	ND	70	ND	284	182	24	ND	74	170	ND	ND	ND	ND
61	10	53	17	290	140	19	1.90	75	130	2.27	0.43	6.7	1
66	10	27	18	270	140	20	1.90	97	130	0.10	0.10	0.9	2
5	120	ND	0.7	10	2.5	2.5	0.25	18000	5	1.56	26.14	125.6	19
21	110	ND	4.2	28	37	2.5	0.25	8000	15	125.31	9.33	88.6	13
17	120	ND	3.8	10	46	2.5	0.25	12000	14	173.13	9.16	74.1	17
15	140	ND	2.5	10	14	2.5	0.25	11000	5	109.59	16.76	97.3	19
19	190	ND	2.7	20	68	2.5	0.25	14000	10	59.72	16.87	124.4	23
20	280	ND	3.2	10	88	2.5	0.25	15000	14	55.90	23.34	207.8	30
25	240	ND	5.3	10	110	2.5	0.25	16000	29	30.77	19.10	139.6	25
31	160	ND	8.3	31	150	8	0.25	11000	46	42.23	13.20	81.5	8
43	290	ND	8	43	140	14	0.25	13000	36	42.15	20.19	219.9	17
49	190	ND	8.7	22	110	7	0.25	9500	39	60.56	16.50	186.1	13
43	250	ND	6.7	10	130	2.5	0.25	11000	38	91.08	17.90	229.2	20
86	29	64	18	190	160	20	2.20	870	130	7.04	2.52	35.9	4
63	55	ND	16	91	160	16	1.40	1900	97	14.00	4.43	94.8	9
68	120	ND	13	70	210	11	1.10	5300	84	33.63	3.86	101.0	15
37	10	66	19	200	140	19	1.80	200	120	1.66	0.46	15.4	1
43	10	47	19	190	150	15	1.20	390	100	2.22	0.68	21.1	2
40	20	48	16	260	120	24	1.90	90	130	0.84	0.49	5.0	1
59	31	85	18	130	140	13	1.20	110	96	1.79	1.22	30.5	5
64	10	74	19	130	150	19	1.70	140	110	0.73	0.50	4.0	1
53	ND	70	ND	123	183	28	ND	131	125	ND	ND	ND	ND
54	10	72	19	130	160	22	2.00	100	120	0.52	0.20	5.7	1
58	0	79	19	98	140	19	1.80	120	110	0.32	0.33	5.7	1
61	10	88	19	77	140	16	1.70	110	120	0.47	0.10	2.6	1
56	10	91	18	78	130	14	1.40	120	110	0.24	0.10	4.9	1
50	10	81	18	81	140	24	2.00	120	130	0.36	0.25	5.6	1
61	10	80	19	76	140	20	1.80	150	120	0.38	0.26	9.9	1
49	10	77	17	80	120	20	1.80	86	170	1.20	0.70	13.0	1
62	10	83	19	62	140	19	1.70	130	130	0.44	0.38	9.8	1
64	ND	87	ND	52	191	22	ND	391	110	ND	ND	ND	ND
39	ND	68	ND	55	170	24	ND	63	150	ND	ND	ND	ND
47	10	78	14	59	110	18	ND	77	210	0.96	0.32	7.5	2
39	10	74	15	48	110	18	1.60	62	170	3.17	0.72	13.3	4
57	10	63	18	55	140	18	1.60	94	150	0.62	0.59	6.7	1
62	39	0	11	34	68	9	0.25	33	87	4.23	1.71	15.4	1
31	ND	44	ND	65	133	17	ND	34	199	ND	ND	ND	ND
65	10	66	21	43	170	17	1.60	82	100	0.74	0.35	4.1	1
49	10	48	18	53	140	23	1.80	82	110	0.32	0.52	6.5	1
52	ND	50	ND	45	187	21	ND	115	115	ND	ND	ND	ND
35	23	24	17	65	120	20	1.90	230	180	0.51	0.47	11.5	1
34	10	30	14	61	90	16	1.30	36	200	0.10	0.10	5.5	1
28	10	25	17	66	130	18	1.60	71	140	0.26	0.10	3.2	1
36	10	31	16	50	120	14	1.20	70	150	0.10	0.10	3.0	1
18	10	18	13	50	100	13	1.10	270	180	0.10	0.10	0.7	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
22	ND	17	ND	58	148	17	ND	117	169	ND	ND	ND	ND
25	10	21	16	59	110	16	1.40	55	190	0.94	0.23	3.2	1
20	10	18	12	39	88	12	1.00	70	150	0.10	0.45	3.6	1
36	10	15	16	44	120	17	1.50	67	160	0.62	0.33	5.2	1
35	ND	15	ND	44	127	18	ND	59	120	ND	ND	ND	ND
43	ND	23	16	52	120	17	1.60	69	130	0.20	0.10	5.0	1
72	150	43	16	10	120	35	2.00	99	150	2.37	1.11	7.3	1
89	28	21	16	10	130	15	1.10	83	130	0.38	2.21	57.1	1
38	10	15	14	10	100	12	0.90	83	170	0.10	0.24	3.4	3
45	10	25	16	10	130	20	1.40	130	130	0.70	0.10	0.8	1
39	10	26	15	10	97	16	1.10	140	110	3.08	0.10	1.0	1
41	10	5	9.2	10	66	12	1.10	350	160	32.46	0.10	1.6	1
46	10	25	18	10	130	14	0.90	100	150	0.75	0.10	0.7	1
19	10	23	11	10	67	21	1.70	200	150	19.64	0.10	0.1	1
27	10	28	15	10	97	13	1.00	130	120	4.78	0.10	0.1	4
20	10	17	12	10	74	11	0.90	140	130	9.45	0.10	0.1	1
16	10	27	14	10	120	10	0.70	110	170	10.72	0.10	0.1	1
64	ND	21	ND	130	311	23	ND	184	164	ND	ND	ND	ND

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Ba	Ag	Be	Ce	Co	Cr	Cu	La	Nb
									parts per million						
139	856B	15X	3	122	124	114.62	220	1	0.3	ND	18	67	2000	14	18
139	856B	15X	4	12	14	115.02	580	1	0.5	ND	18	65	420	18	15
139	856B	15X	4	70	72	115.60	520	1	0.9	ND	24	89	570	14	5
139	856B	15X	4	130	132	116.20	470	1	0.8	ND	29	97	1000	19	ND
139	856B	15X	5	8	10	116.48	850	1	1.2	ND	23	100	2200	27	16
139	856B	15X	5	76	78	117.16	510	1	0.5	ND	20	49	2300	17	5
139	856B	15X	5	106	108	117.46	330	2	0.6	ND	20	77	3200	18	16
139	856B	15X	6	6	8	117.96	50	1	0.6	ND	2.5	5	490	5	16
139	856B	15X	CC	20	22	118.22	15	2	0.3	ND	39	57	7200	5	ND
139	856D	01H	1	3	6	0.03	20000	8	0.3	ND	2.5	5	2100	5	ND
139	856D	01H	1	15	18	0.15	32000	10	0.3	ND	2.5	5	2300	5	ND
139	856D	01H	1	34	37	0.34	79000	6	0.3	ND	10	52	1500	5	ND
139	856D	01H	1	39	42	0.39	37000	9	0.3	ND	2.5	5	2000	5	ND
139	856D	01H	1	66	69	0.66	4000	4	0.3	ND	2.5	5	2000	5	ND
139	856D	01H	1	89	93	0.89	30	3	0.3	ND	2.5	5	1500	5	ND
139	856D	01H	1	112	115	1.12	80	2	0.3	ND	2.5	5	2100	5	ND
139	856D	01H	1	135	138	1.35	5800	3	0.3	ND	2.5	5	3700	5	ND
139	856D	01H	2	10	14	1.60	840	2	0.3	ND	2.5	5	2400	5	ND
139	856D	01H	2	43	46	1.93	17000	1	0.3	ND	2.5	21	1300	5	ND
139	856D	01H	2	57	59	2.07	510	1	0.7	ND	2.5	5	980	5	ND
139	856D	01H	3	16	20	3.16	830	2	0.3	ND	2.5	5	3900	5	ND
139	856D	01H	3	32	36	3.32	50	2	0.3	ND	2.5	5	5000	5	ND
139	856D	01H	3	90	94	3.90	980	2	0.3	ND	2.5	5	3400	5	ND
139	856D	01H	3	121	124	4.21	80	2	0.3	ND	2.5	5	2700	5	ND
139	856D	01H	4	25	28	4.75	570	3	0.3	ND	2.5	5	3300	5	ND
139	856D	01H	4	114	116	5.64	980	2	0.3	ND	2.5	5	3400	5	ND
139	856D	01H	4	145	148	5.95	860	2	0.3	ND	5	5	5100	5	ND
139	856D	01H	5	54	57	6.54	1000	1	0.5	ND	5	5	3100	5	ND
139	856D	01H	5	66	69	6.66	780	1	0.3	ND	6	5	3300	5	ND
139	856D	01H	5	88	91	6.88	30	1	0.3	ND	2.5	5	5200	5	ND
139	856D	01H	7	46	48	7.89	10000	3	0.3	ND	6	5	2400	5	ND
139	856D	01H	7	70	71	8.13	12000	3	0.3	ND	5	5	2100	5	ND
139	856E	01H	1	48	50	0.48	18000	10	1.1	ND	21	78	3500	5	ND
139	856E	01H	1	73	75	0.73	4500	1	1.3	ND	17	75	430	20	5
139	856E	01H	1	90	92	0.90	9100	3	1.1	ND	15	93	2000	14	ND
139	856E	01H	1	96	98	0.96	18000	48	0.7	ND	48	72	9400	5	ND
139	856E	01H	1	129	131	1.29	88000	7	0.3	ND	15	77	2600	5	ND
139	856E	01H	2	55	57	2.05	47000	5	0.3	ND	17	95	2300	5	ND
139	856F	02X	CC	23	25	11.93	120	1	0.3	ND	8	5	2700	5	ND
139	856G	01R	3	84	86	3.84	2700	3	0.3	ND	2.5	5	6400	5	ND
139	856G	01R	3	112	114	4.12	2400	5	0.3	ND	2.5	5	4700	5	ND
139	856G	02R	2	54	56	10.64	1600	1	0.9	ND	2.5	5	2100	5	ND
139	856G	03R	1	12	14	17.72	15	6	0.3	ND	62	5	2200	5	ND
139	856G	03R	1	30	32	17.90	110	1	0.3	ND	66	5	4200	5	ND
139	856G	03R	1	35	37	17.95	100	1	0.3	ND	55	5	9400	5	ND
139	856G	03R	1	81	84	18.41	50	1	0.3	ND	18	5	3600	5	ND
139	856G	04R	1	83	85	27.83	50	1	0.3	ND	37	5	4200	5	ND
139	856G	05R	1	34	36	37.04	100	1	0.3	ND	23	5	1900	5	ND
139	856G	05R	1	59	61	37.29	140	1	0.3	ND	2.5	5	2100	5	ND
139	856G	06R	1	19	21	46.49	60	1	0.3	ND	2.5	5	190	5	ND
139	856G	06R	1	24	28	46.54	70	1	0.3	ND	80	5	160	5	ND
139	856G	06R	1	71	73	47.01	30	1	0.3	ND	2.5	5	1700	5	ND
139	856G	06R	2	80	82	48.60	160	1	0.3	ND	44	5	2100	5	ND
139	856G	06R	2	87	89	48.67	70	1	0.3	ND	2.5	5	1800	5	ND
139	856G	06R	3	13	16	49.43	30	1	0.3	ND	55	5	1300	5	ND
139	856G	06R	3	17	19	49.47	80	1	0.3	ND	2.5	5	1600	5	ND
139	856G	06R	3	87	89	50.17	90	1	0.3	ND	2.5	5	620	5	ND
139	856G	06R	3	129	131	50.59	40	4	0.3	ND	67	5	1200	5	ND
139	856G	06R	3	132	134	50.62	40	1	0.3	ND	22	5	1800	5	ND
139	856G	07R	1	1	3	55.81	40	1	0.3	ND	48	5	5600	5	ND
139	856G	07R	1	21	23	56.01	90	11	0.3	ND	120	5	3700	5	ND
139	856G	07R	1	42	43	56.22	15	9	0.3	ND	84	61	1200	5	ND
139	856G	07R	1	46	47	56.26	50	4	0.3	ND	380	5	10000	5	ND
139	856G	07R	2	46	48	57.66	60	3	0.3	ND	170	5	6300	5	ND
139	856G	07R	2	120	122	58.40	40	1	0.3	ND	10	5	2000	5	ND
139	856G	07R	3	103	106	59.72	40	4	0.3	ND	220	5	6500	5	ND
139	856G	07R	3	103	106	59.72	60	5	0.3	ND	71	5	780	5	ND
139	856G	07R	3	123	125	59.92	90	1	0.3	ND	20	5	3900	5	ND
139	856G	07R	4	35	37	60.45	60	1	0.3	ND	14	5	3400	5	ND
139	856H	03R	1	28	30	22.38	2900	1	0.3	ND	15	5	3200	5	ND
139	856H	03R	1	38	40	22.48	270	1	0.3	ND	87	5	3600	5	ND
139	856H	03R	1	60	62	22.70	70	1	0.3	ND	54	5	7300	5	ND
139	856H	03R	1	75	77	24.01	230	1	0.3	ND	76	5	12000	5	ND
139	856H	03R	2	16	18	23.42	110	1	0.3	ND	34	5	9700	5	ND
139	856H	03R	2	84	87	24.10	40	1	0.3	ND	28	5	8000	5	ND
139	856H	03R	2	135	138	24.61	40	1	0.3	ND	23	5	4300	5	ND
139	856H	03R	3	17	19	24.88	40	1	0.3	ND	29	5	3900	5	ND
139	856H	03R	3	72	74	25.43	40	1	0.3	ND	52	5	12000	5	ND
139	856H	04R	1	21	23	26.81	15	1	0.3	ND	12	5	4300	5	ND
139	856H	04R	1	65	67	27.25	30	1	0.3	ND	42	5	5100	5	ND
139	856H	04R	1	88	90	27.48	15	1	0.3	ND	57	5	7000	5	ND
139	856H	04R	1	124	126	27.84	40	7	0.3	ND	250	5	3100	5	ND
139	856H	04R	1	135	137	27.95	110	1	0.3	ND	37	5	1700	5	ND
139	856H	04R	2	6	8	28.16	50	1	0.3	ND	45	5	13000	5	ND
139	856H	04R	2	17	19	28.27	40	2	0.3	ND	150	5	6100	5	ND
139	856H	04R	2	43	45	28.53	40	1	0.3	ND	48	5	4300	5	ND
139	856H	04R	2	96	98	29.06	180	1	0.3	ND	99	5	3800	5	ND
139	856H	04R	2	131	133	29.41	70	1	0.3	ND	79	5	2600	5	ND

Table 1 (continued).

Ni	Pb	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As	Mo
parts per million													
23	10	12	11	10	68	20	1.50	92	130	2.07	0.10	0.1	1
22	10	28	15	38	64	12	1.10	81	130	1.41	0.10	0.1	1
47	10	30	18	23	140	15	1.20	88	110	1.87	0.10	0.3	1
40	10	ND	18	330	160	25	1.90	590	220	4.23	0.10	1.4	1
48	10	42	25	44	120	27	2.10	76	220	3.48	0.10	0.3	3
35	10	19	14	130	91	19	1.70	64	140	4.70	0.10	0.1	1
26	10	12	12	54	73	14	1.10	64	210	12.03	0.10	0.1	1
5	10	5	15	90	18	16	1.90	2.5	130	1.33	0.10	0.3	1
31	10	ND	10	65	38	10	0.90	110	95	27.57	0.10	18.8	1
5	120	ND	0.7	360	2.5	2.5	0.25	2800	5	45.62	7.76	64.6	135
5	120	ND	0.7	380	9	2.5	0.25	3700	5	43.49	18.83	137.1	206
5	31	ND	0.6	490	12	2.5	0.90	2200	5	31.17	25.07	162.9	237
5	160	ND	0.7	500	2.5	2.5	0.25	1500	5	41.60	23.08	157.9	264
5	140	ND	0.3	94	2.5	2.5	0.25	27000	5	33.60	14.96	45.8	124
13	120	ND	0.3	10	2.5	2.5	0.25	28000	5	26.23	13.21	34.9	51
11	100	ND	0.3	10	2.5	2.5	0.25	31000	5	29.22	15.53	46.8	34
5	45	ND	0.3	140	2.5	2.5	0.25	26000	5	39.36	13.07	29.4	45
5	44	ND	0.3	27	2.5	2.5	0.25	36000	5	35.82	9.04	41.2	71
5	10	ND	0.3	410	2.5	2.5	0.25	20000	5	12.87	6.34	16.2	22
5	24	ND	0.3	10	2.5	2.5	0.25	14000	5	15.27	4.09	10.8	38
5	33	ND	0.3	36	2.5	2.5	0.25	40000	5	75.28	2.87	8.1	78
11	34	ND	0.3	10	2.5	2.5	0.25	48000	5	93.09	2.46	4.8	72
5	39	ND	0.3	30	2.5	2.5	0.25	37000	5	70.18	4.00	11.8	58
10	56	ND	0.3	10	2.5	2.5	0.25	37000	5	64.71	3.02	15.6	45
5	53	ND	0.3	22	2.5	5	0.25	36000	5	68.13	3.90	14.6	61
5	60	ND	0.3	31	2.5	2.5	0.25	37000	5	68.83	2.60	15.7	73
5	33	ND	0.3	22	2.5	2.5	0.25	40000	5	71.57	4.12	36.0	130
5	38	ND	0.3	35	2.5	2.5	0.25	44000	5	76.00	1.60	13.1	54
5	32	ND	0.3	34	2.5	2.5	0.25	79000	5	75.28	1.36	10.2	53
5	10	ND	ND	10	2.5	2.5	0.25	22000	5	53.06	4.10	28.3	102
5	47	ND	0.5	370	2.5	2.5	0.25	62000	5	78.41	4.72	35.4	37
5	39	ND	0.3	360	2.5	2.5	0.25	41000	5	89.66	4.97	37.5	37
5	430	ND	10	550	380	12	0.90	44000	82	77.39	52.34	94.9	40
5	180	56	13	340	170	23	1.40	5500	85	4.70	13.37	31.9	13
5	230	ND	14	480	180	18	1.40	11000	120	8.81	13.48	86.7	32
5	1500	ND	6.9	460	290	7	0.25	61000	42	85.07	99.78	590.0	107
5	51	ND	0.7	470	49	2.5	1.40	23000	5	30.22	35.11	388.2	107
5	25	ND	0.7	360	12	2.5	2.40	11000	5	18.55	25.27	253.0	207
5	10	ND	0.3	21	2.5	2.5	0.25	20000	5	91.06	0.27	1.7	13
5	140	ND	0.8	84	2.5	2.5	0.25	780	5	98.78	6.49	35.6	210
5	200	ND	0.8	89	2.5	2.5	0.25	1000	5	113.71	13.94	88.2	111
5	10	ND	0.3	45	2.5	2.5	0.25	3500	5	9.36	6.77	512.4	27
5	35	ND	0.6	10	2.5	2.5	0.25	4800	5	ND	ND	ND	ND
5	21	ND	ND	10	2.5	2.5	0.25	15000	5	ND	ND	ND	ND
5	10	ND	1.2	10	2.5	2.5	0.25	7300	5	ND	ND	ND	ND
12	23	ND	1.5	10	2.5	2.5	0.25	2800	5	46.40	1.49	15.3	8
5	29	ND	1	10	2.5	2.5	0.25	1200	5	53.34	0.10	0.8	17
5	10	ND	1.2	10	2.5	2.5	0.25	94	5	ND	ND	ND	ND
5	10	ND	0.7	26	2.5	2.5	0.25	43	5	43.24	0.44	4.3	23
5	78	ND	0.7	10	2.5	2.5	0.25	4000	5	0.61	1.71	60.3	13
5	65	ND	0.8	10	2.5	2.5	0.25	570	5	ND	ND	ND	ND
16	24	ND	0.7	10	2.5	2.5	0.25	82	5	28.16	0.10	10.6	32
5	51	ND	0.8	10	2.5	2.5	0.25	61	5	ND	ND	ND	ND
13	50	ND	0.7	10	2.5	2.5	0.25	380	5	8.15	0.45	4.5	29
5	57	ND	0.7	10	2.5	2.5	0.25	150	5	ND	ND	ND	ND
5	43	ND	0.7	10	2.5	2.5	0.25	26	5	7.30	0.36	2.8	20
11	26	ND	0.6	10	2.5	2.5	0.25	4600	5	3.73	0.25	1.4	25
5	38	ND	0.6	10	2.5	2.5	0.25	2400	5	ND	ND	ND	ND
12	21	ND	0.5	10	2.5	2.5	0.25	49	5	11.24	0.26	2.4	29
10	20	ND	0.7	10	2.5	2.5	0.25	96	5	19.80	0.10	3.3	15
5	46	ND	0.7	10	2.5	2.5	0.25	92	5	ND	ND	ND	ND
36	260	ND	0.3	10	2.5	2.5	0.80	13000	5	ND	ND	ND	ND
5	55	ND	1.1	10	2.5	2.5	0.25	1500	5	ND	ND	ND	ND
5	43	ND	1.1	10	2.5	2.5	0.25	150	5	ND	ND	ND	ND
17	74	ND	0.3	10	2.5	2.5	0.25	42000	5	3.45	4.49	12.0	90
5	93	ND	0.9	10	2.5	2.5	0.25	250	5	ND	ND	ND	ND
5	52	ND	0.9	10	2.5	2.5	0.25	4900	5	ND	ND	ND	ND
5	130	ND	0.8	10	2.5	2.5	0.25	32000	5	7.92	6.82	143.1	28
5	100	ND	0.8	10	2.5	2.5	0.25	17000	5	5.83	3.56	82.5	25
5	10	ND	0.7	78	2.5	2.5	0.25	49000	5	85.27	0.69	1.0	3
5	23	ND	0.9	10	2.5	2.5	0.25	40000	5	108.56	0.40	0.9	ND
5	29	ND	0.9	10	2.5	2.5	0.00	24000	5	110.60	0.10	0.4	8
5	22	ND	0.9	23	2.5	2.5	0.25	63000	5	96.20	0.10	1.4	ND
5	20	ND	0.8	26	2.5	2.5	0.25	34000	5	77.32	0.60	2.1	29
10	10	ND	0.7	21	2.5	2.5	0.25	60000	5	86.57	0.28	2.8	1
5	23	ND	0.8	10	2.5	2.5	0.25	35000	5	94.38	0.10	0.5	1
5	28	ND	0.7	10	2.5	2.5	0.25	27000	5	86.10	0.35	5.1	8
5	23	ND	2	10	2.5	2.5	0.25	7300	5	87.23	0.10	0.5	1
15	10	ND	4.4	10	14	2.5	0.25	23000	39	53.80	0.92	4.3	1
5	10	ND	2.7	10	19	2.5	0.25	35000	12	68.57	0.10	1.0	ND
12	10	ND	1.4	10	10	2.5	0.25	23000	5	94.27	0.10	2.4	1
5	20	ND	1.1	10	20	2.5	0.25	12000	5	85.98	0.10	0.6	ND
5	28	ND	0.8	10	2.2	2.5	0.25	12000	5	59.13	1.41	9.2	1
5	10	ND	1.5	10	2.5	2.5	0.25	59000	5	166.01	0.33	2.0	1
5	10	ND	1.1	10	14	2.5	0.25	1400	5	78.51	0.10	0.1	ND
5	10	ND	1.6	10	7	2.5	0.25	76000	5	86.13	0.10	0.3	1
5	10	ND	1.5	10	2.5	2.5	0.25	23000	5	95.84	0.39	1.0	ND
5	10	ND	1	10	2.5	2.5	0.25	2900	5	60.02	0.10	0.1	15

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Ba	Ag	Be	Ce	Co	Cr	Cu	La	Nb
									parts per million						
139	856H	04R	3	16	17	29.72	40	1	0.3	ND	29	5	9700	5	ND
139	856H	06R	1	39	41	37.79	7500	1	0.3	ND	13	5	1800	5	ND
139	856H	07R	1	38	40	43.48	15	2	0.3	ND	72	72	1100	5	ND
139	856H	07R	1	45	47	43.55	230	1	0.3	ND	8	5	2200	5	ND
139	856H	08R	1	28	30	48.28	160	2	0.3	ND	67	5	1400	5	ND
139	856H	08R	1	23	25	48.23	40	1	0.3	ND	6	5	2900	5	ND
139	856H	08R	1	72	74	48.72	33000	4	0.3	ND	110	5	440	5	ND
139	856H	08R	1	118	121	49.18	80	2	0.3	ND	120	5	3400	5	ND
139	856H	09R	1	68	70	53.18	90	1	0.3	ND	62	5	8000	5	ND
139	856H	09R	1	80	82	53.30	120	1	0.3	ND	40	5	2700	5	ND
139	856H	10R	1	20	22	57.20	130	2	0.3	ND	73	5	13000	5	ND
139	856H	11R	1	25	27	61.55	60	1	0.3	ND	210	5	5800	5	ND
139	856H	11R	1	91	93	62.21	50	1	0.3	ND	51	5	2000	5	ND
139	856H	11R	1	108	110	62.38	15	7	0.3	ND	230	74	8600	5	ND
139	856H	11R	1	114	117	62.44	30	2	0.3	ND	220	5	13000	5	ND
139	856H	13R	1	43	46	71.33	30	2	0.3	ND	450	5	6800	5	ND
139	856H	14R	1	16	18	75.86	170	7	0.3	ND	130	5	8000	5	ND
139	856H	14R	1	28	30	75.98	60	1	0.3	ND	260	5	20000	5	ND
139	856H	14R	1	84	86	76.54	50	1	0.3	ND	76	5	12000	5	ND
139	856H	14R	1	108	110	76.78	50	1	0.3	ND	160	5	10000	5	ND
139	856H	15R	1	73	76	81.23	40	10	0.3	ND	75	5	8000	5	ND
139	856H	15R	1	74	76	81.24	40	1	0.3	ND	47	5	7400	5	ND
139	856H	15R	1	118	120	81.68	60	1	0.3	ND	120	5	12000	5	ND
139	856H	16R	1	27	29	85.47	50	1	0.3	ND	160	5	8100	5	ND
139	856H	16R	1	53	55	85.73	50	1	0.3	ND	190	5	16000	5	ND
139	857A	01H	2	80	84	4.20	662	0	ND	26	ND	80	48	ND	12
139	857A	01H	2	90	94	4.30	640	1	1.6	ND	19	73	53	23	10
139	857A	01H	4	46	50	6.86	620	1	1.2	ND	24	110	58	16	12
139	857A	01H	6	76	80	10.16	990	1	1.5	ND	18	77	55	18	10
139	857A	02H	1	126	128	12.66	590	1	1.2	ND	20	89	41	19	11
139	857A	02H	2	73	75	13.63	663	0	ND	8	ND	106	62	ND	10
139	857A	02H	3	125	127	15.65	990	1	1.6	ND	22	81	56	21	10
139	857A	02H	5	126	128	18.66	730	1	1.5	ND	22	83	62	18	10
139	857A	02H	7	44	46	20.84	660	1	1.3	ND	21	74	47	21	10
139	857A	04H	2	67	71	24.07	770	1	1.5	ND	17	89	45	21	13
139	857A	04H	2	86	90	24.26	742	0	ND	14	ND	103	45	ND	11
139	857A	04H	4	25	29	26.65	670	1	1.6	ND	19	90	50	21	11
139	857A	04H	6	25	29	29.65	660	1	1.8	ND	18	91	46	27	10
139	857A	05H	2	27	31	33.17	640	1	1.7	ND	22	87	52	22	12
139	857A	05H	3	78	82	35.18	891	0	ND	14	ND	103	47	ND	13
139	857A	05H	4	45	49	36.35	520	1	1.4	ND	15	71	30	20	14
139	857A	05H	6	54	58	39.44	460	1	1.3	ND	18	73	43	17	10
139	857A	06H	1	143	147	42.33	510	1	1.2	ND	13	76	30	20	10
139	857A	06H	3	52	56	44.42	560	1	1.5	ND	20	82	48	19	16
139	857A	06H	4	54	58	45.94	763	ND	ND	24	ND	111	48	ND	14
139	857A	06H	5	89	93	47.79	530	1	1.1	ND	16	79	33	18	11
139	857A	06H	7	20	24	50.10	610	1	1.3	ND	18	82	40	19	14
139	857A	07H	2	22	26	50.94	510	1	1.1	ND	14	97	20	21	12
139	857A	07H	3	69	73	52.91	852	ND	ND	69	ND	100	56	ND	17
139	857A	07H	3	87	93	53.09	620	ND	ND	ND	1.4	ND	14	73	32
139	857A	07H	4	64	68	54.26	540	1	1.2	ND	17	100	29	21	14
139	857A	07H	6	109	113	56.77	480	1	1.3	ND	21	83	46	18	10
139	857A	08H	2	32	36	61.72	470	1	1.3	ND	18	75	49	16	14
139	857A	08H	2	95	99	62.35	508	ND	ND	6	ND	94	53	ND	10
139	857A	08H	5	13	17	66.03	670	1	1.3	ND	19	85	41	18	15
139	857A	08H	5	47	51	66.37	520	1	1.5	ND	25	88	55	18	13
139	857A	08H	6	61	65	68.01	560	1	1.2	ND	21	84	38	17	10
139	857A	08H	7	3	7	68.93	520	1	1.5	ND	22	83	49	19	19
139	857A	09H	2	93	98	71.83	646	ND	ND	12	ND	106	55	ND	12
139	857A	09H	3	40	45	72.80	600	1	1.4	ND	22	90	43	19	13
139	857A	09H	5	105	109	76.45	600	1	1.2	ND	17	85	27	18	10
139	857A	09H	ND	53	55	78.00	580	1	1.3	ND	19	82	35	18	11
139	857A	10H	1	95	97	79.85	650	1	1.4	ND	21	90	43	20	10
139	857A	10H	2	79	81	81.19	601	ND	ND	10	ND	104	41	ND	10
139	857A	10H	4	77	79	84.17	540	1	1.2	ND	17	98	26	18	10
139	857A	10H	6	19	21	86.59	630	1	1.2	ND	18	98	32	19	10
139	857A	11X	CC	26	28	87.33	310	1	0.9	ND	6	40	20	10	10
139	857A	13X	1	25	27	101.75	490	1	1.2	ND	19	97	40	17	12
139	857A	13X	1	62	63	102.12	590	1	1.3	ND	21	100	53	16	12
139	857A	13X	1	91	93	102.41	440	1	1.2	ND	21	91	44	16	10
139	857A	13X	1	136	139	102.86	560	1	1.4	ND	25	96	58	16	11
139	857A	13X	3	65	67	105.15	520	1	1.4	ND	22	86	50	17	11
139	857A	13X	3	122	124	105.72	548	ND	ND	15	ND	94	44	ND	11
139	857A	13X	CC	33	35	108.87	460	1	1.3	ND	20	78	46	18	11
139	857C	02R	1	63	67	57.13	655	ND	ND	9	ND	108	54	ND	12
139	857C	02R	2	6	10	58.06	610	1	1.4	ND	21	87	39	20	11
139	857C	03R	1	72	74	67.22	670	1	1.5	ND	21	86	51	18	10
139	857C	03R	3	38	40	69.88	515	ND	ND	10	ND	105	52	ND	10
139	857C	03R	3	110	112	70.60	560	1	1.4	ND	22	89	50	18	16
139	857C	05R	1	4	8	82.14	345	ND	ND	6	ND	67	35	ND	6
139	857C	05R	1	12	16	82.22	490	1	1.2	ND	19	86	45	15	10
139	857C	05R	4	110	113	84.00	610	1	1.2	ND	21	49	43	14	10
139	857C	06R	1	1	2	86.21	190	1	0.6	ND	5	22	17	10	10
139	857C	06R	1	33	35	86.53	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	857C	06R	1	66	68	86.86	546	ND	ND	6	ND	102	57	ND	9
139	857C	06R	2	101	103	88.71	520	1	1.3	ND	19	89	45	14	10
139	857C	07R	CC	1	2	95.21	220	1	0.6	ND	5	30	15	10	10
139	857C	08R	CC	3	4	104.93	230	1	0.7	ND	5	39	16	10	10
139	857C	09R	1	8	9	114.58	250	1	0.8	ND	5	29	22	10	11
139	857C	09R	1	27	30	114.77	618	ND	ND	5	ND	91	58	ND	11
139	857C	09R	1	89	91	115.39	480	1	1.2	ND	17	69	43	18	12

Table 1 (continued).

Ni	Pb	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As	Mo
parts per million													
5	10	ND	1.3	10	2.5	2.5	0.25	19000	5	126.78	0.10	0.5	1
5	10	ND	0.8	160	2.5	2.5	0.25	9200	5	136.44	0.10	2.3	96
29	30	ND	0.6	10	2.5	2.5	1.40	780	5	11.21	0.10	1.6	ND
5	28	ND	0.7	10	2.5	2.5	0.25	4200	5	36.98	0.20	4.8	17
5	42	ND	0.7	10	2.5	2.5	0.25	1800	5	ND	ND	ND	ND
5	35	ND	0.8	10	2.5	2.5	0.25	3400	5	14.10	0.10	2.3	13
5	20	ND	0.8	73	2.5	2.5	0.25	14000	5	0.79	4.86	149.8	ND
5	180	ND	0.8	10	2.5	2.5	0.25	1800	5	23.52	5.11	121.1	16
5	170	ND	0.9	10	2.5	2.5	0.25	1300	5	14.93	6.82	97.7	9
5	120	ND	0.8	10	2.5	2.5	0.25	950	5	18.83	4.45	63.7	22
5	93	ND	1	10	2.5	2.5	0.25	7500	5	31.45	3.79	44.9	11
5	58	ND	0.8	10	2.5	2.5	0.25	430	5	46.45	4.86	44.2	4
5	36	ND	0.7	10	2.5	2.5	0.25	120	5	16.40	4.61	30.8	23
33	140	ND	0.7	10	2.5	2.5	1.40	740	5	32.69	31.92	106.7	ND
5	190	ND	0.7	10	2.5	2.5	0.25	390	5	38.64	21.11	114.7	18
5	100	ND	0.6	10	2.5	2.5	0.25	360	5	66.15	4.42	53.8	ND
5	69	ND	0.8	10	2.5	2.5	0.25	770	5	66.15	4.42	53.8	ND
5	61	ND	1.2	10	2.5	2.5	0.25	1200	5	70.12	0.10	0.4	1
5	38	ND	1.1	10	2.5	2.5	0.25	810	5	37.09	0.10	0.2	1
5	44	ND	1.3	55	2.5	2.5	0.25	2000	5	45.72	0.65	0.8	25
5	53	ND	0.9	10	2.5	2.5	0.25	26000	5	62.97	0.10	0.1	ND
16	45	ND	1.2	10	2.5	2.5	0.25	35000	5	57.39	0.10	0.3	20
16	41	ND	1.2	10	2.5	2.5	0.25	6500	5	132.78	0.10	0.2	33
5	42	ND	1.2	10	2.5	2.5	0.25	610	5	67.30	0.10	0.4	46
14	26	ND	1.1	10	2.5	2.5	0.25	570	5	46.97	0.10	0.3	2
42	ND	91	ND	271	162	26	ND	106	173	ND	ND	ND	ND
42	10	80	17	350	120	22	2.20	93	140	0.56	0.70	4.8	1
72	10	50	17	390	130	19	1.70	100	120	0.68	0.79	4.0	1
55	10	82	15	410	120	17	1.60	120	98	1.19	0.75	6.2	1
49	10	48	18	340	140	22	2.10	82	180	0.62	0.33	3.8	1
68	ND	65	ND	266	182	22	ND	123	140	ND	ND	ND	ND
56	10	81	16	420	130	20	1.80	120	100	0.80	0.63	8.9	1
51	10	77	18	270	150	19	1.80	110	110	1.50	0.42	3.2	1
41	10	62	17	380	130	20	1.90	85	140	0.65	0.39	5.3	1
47	10	72	15	300	130	19	1.80	120	150	0.80	0.63	3.3	1
56	ND	68	ND	276	160	22	ND	118	190	ND	ND	ND	ND
55	10	75	16	280	120	18	1.70	110	140	1.35	0.66	6.9	1
50	10	97	16	320	120	19	1.80	100	150	0.61	0.45	6.8	1
56	10	85	17	310	130	19	1.70	110	120	0.40	0.44	3.9	1
61	ND	104	ND	244	157	21	ND	130	147	ND	ND	ND	ND
48	10	68	13	270	100	17	1.50	82	150	1.24	0.55	15.3	5
52	10	59	16	300	120	19	1.80	100	130	1.08	0.85	4.4	1
34	10	57	14	370	110	19	1.80	66	180	0.10	0.21	4.6	1
54	10	73	16	310	130	20	1.80	110	120	0.60	0.43	13.9	1
56	ND	95	ND	285	150	23	ND	122	168	ND	ND	ND	ND
40	10	39	15	430	120	20	2.00	73	160	0.62	0.34	6.0	1
49	10	63	15	390	110	20	1.90	84	150	0.27	0.35	5.0	1
34	10	30	13	440	100	18	1.90	63	270	0.38	0.31	5.3	1
64	ND	80	ND	279	152	22	ND	115	131	ND	ND	ND	ND
17	11	48	10	54	12	370	84	16	1.50	81	110	0.24	0.36
48	10	43	14	370	100	20	2.00	77	200	0.56	1.26	23.3	1
53	10	55	17	320	130	20	2.00	96	130	0.37	0.42	7.7	1
42	10	63	18	290	140	19	1.90	100	110	0.98	0.24	2.5	1
49	ND	57	ND	269	179	25	ND	101	164	ND	ND	ND	ND
47	10	55	16	350	130	19	1.80	91	150	1.15	0.41	8.3	1
69	10	69	18	280	150	20	2.00	140	130	1.60	0.36	9.3	1
52	10	59	16	350	120	19	1.90	90	140	0.69	0.67	8.8	1
57	10	65	18	290	140	21	2.00	100	130	0.61	0.40	9.1	1
61	ND	74	ND	270	174	23	ND	121	161	ND	ND	ND	ND
60	10	64	17	360	130	19	1.90	91	130	1.22	0.40	6.3	1
42	10	48	14	430	100	18	1.70	60	170	0.56	0.31	7.0	4
43	10	51	16	410	120	18	1.80	79	140	1.09	0.26	3.7	1
53	10	64	17	350	130	21	2.00	91	140	0.57	0.30	6.2	1
49	ND	57	ND	319	158	23	ND	87	188	ND	ND	ND	ND
42	10	39	13	430	100	17	1.80	58	190	0.21	0.27	7.1	1
49	10	42	15	440	110	18	1.80	78	170	0.36	0.52	7.3	1
27	10	35	6.9	240	51	8	0.50	35	56	1.63	0.24	1.7	1
58	10	52	18	320	130	20	2.00	80	150	0.95	0.24	6.0	1
59	10	64	20	260	150	22	2.20	100	130	2.03	0.25	2.4	1
55	10	48	19	300	130	20	2.00	89	140	1.19	0.48	11.4	1
60	10	65	20	250	150	19	1.90	110	110	1.22	0.35	4.8	1
51	10	65	19	250	140	21	2.10	100	130	1.61	0.31	7.4	1
46	ND	68	ND	230	163	25	ND	98	171	ND	ND	ND	ND
43	10	56	19	300	130	22	2.20	87	130	0.33	0.35	5.2	1
75	ND	71	ND	292	171	23	ND	134	165	ND	ND	ND	ND
59	10	67	17	350	120	20	1.90	89	140	0.97	0.28	3.3	1
53	10	75	19	290	140	20	2.00	99	130	1.52	0.30	6.1	1
50	ND	61	ND	250	187	25	ND	102	152	ND	ND	ND	ND
53	10	63	19	290	140	21	2.00	93	130	0.94	0.26	3.1	1
30	ND	42	ND	229	113	16	ND	57	102	ND	ND	ND	ND
50	10	53	18	300	130	20	2.00	88	110	0.79	0.25	2.5	1
31	10	44	17	490	120	17	1.70	78	99	1.56	0.20	5.4	1
15	10	15	5.3	240	37	7	0.50	26	42	0.10	0.10	1.8	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
58	ND	66	ND	215	187	22	ND	115	133	ND	ND	ND	ND
60	10	61	18	290	130	17	1.70	94	110	1.44	0.22	3.1	1
17	10	16	7.3	270	51	9	0.60	27	55	0.10	0.10	2.9	1
22	10	21	7.2	270	50	12	0.80	32	61	3.18	0.10	2.5	1
14	10	27	7.6	230	57	11	0.60	31	42	2.62	0.10	1.2	1
46	ND	78	ND	248	188	22	ND	121	154	ND	ND	ND	ND
36	10	55	18	300	120	23	2.10	72	140	0.46	0.10	6.6	1

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Ba	Ag	Be	Ce	Co	Cr	Cu	La	Nb
									parts per million						
139	857C	10R	1	65	67	124.75	570	1	1.8	ND	22	90	49	20	11
139	857C	11R	1	124	126	135.04	495	ND	ND	8	ND	97	32	ND	9
139	857C	12R	1	9	10	143.59	290	1	0.8	ND	5	49	17	11	10
139	857C	12R	1	40	43	143.90	460	1	1.1	ND	16	79	29	15	10
139	857C	12R	1	47	48	143.97	300	1	0.7	ND	12	43	16	12	10
139	857C	12R	1	80	83	144.30	608	ND	ND	7	ND	108	57	ND	10
139	857C	12R	1	126	127	144.76	280	1	0.9	ND	7	49	24	11	10
139	857C	13R	1	6	8	153.16	440	1	1.0	ND	12	55	23	13	10
139	857C	13R	1	52	55	153.62	470	1	1.2	ND	19	79	37	15	11
139	857C	13R	2	48	51	155.08	14	ND	ND	529	ND	103	58	ND	9
139	857C	13R	3	52	54	156.62	450	1	1.1	ND	17	81	30	15	10
139	857C	14R	2	27	31	164.57	541	ND	ND	5	ND	77	40	ND	9
139	857C	14R	2	50	54	164.80	490	1	1.1	ND	17	65	31	14	10
139	857C	15R	1	93	95	173.43	515	ND	ND	4	ND	95	52	ND	9
139	857C	15R	1	147	149	173.97	440	1	1.0	ND	14	54	28	15	10
139	857C	15R	3	142	144	176.92	570	1	1.2	ND	24	63	55	13	10
139	857C	16R	1	15	17	182.35	497	ND	ND	4	ND	96	33	ND	9
139	857C	17R	1	82	86	192.72	597	ND	ND	5	ND	86	48	ND	9
139	857C	17R	2	61	65	194.01	520	1	1.3	ND	21	67	46	14	10
139	857C	18R	1	76	80	202.36	552	ND	ND	6	ND	104	55	ND	10
139	857C	18R	2	30	34	203.40	520	1	1.4	ND	22	88	48	17	10
139	857C	19R	2	57	61	213.37	530	1	1.4	ND	24	71	51	14	13
139	857C	19R	2	78	82	213.58	530	ND	ND	14	ND	99	43	ND	11
139	857C	21R	1	24	26	230.84	460	1	1.3	ND	18	84	33	18	10
139	857C	21R	1	129	131	231.89	532	ND	ND	5	ND	98	36	ND	10
139	857C	21R	3	27	29	233.87	500	1	1.3	ND	19	84	35	17	13
139	857C	22R	1	28	32	240.58	520	1	1.4	ND	21	87	43	18	13
139	857C	22R	1	124	127	241.54	529	ND	ND	17	ND	104	41	ND	10
139	857C	22R	CC	1	5	242.01	280	1	1.0	ND	7	48	25	12	14
139	857C	24R	1	31	35	259.51	400	1	1.2	ND	16	73	34	15	11
139	857C	24R	1	57	59	259.77	480	1	1.4	ND	27	89	57	16	14
139	857C	24R	2	5	7	260.75	490	1	1.4	ND	24	91	53	16	16
139	857C	24R	2	33	37	261.03	13	ND	ND	517	ND	108	55	ND	10
139	857C	25R	1	6	8	268.86	530	1	1.5	ND	23	93	52	16	19
139	857C	25R	1	51	54	269.31	535	ND	ND	16	ND	111	52	ND	10
139	857C	26R	1	18	20	274.68	460	1	1.5	ND	26	87	60	16	15
139	857C	26R	1	66	68	275.16	471	ND	ND	12	ND	96	56	ND	9
139	857C	26R	CC	1	3	276.24	420	1	0.9	ND	9	61	15	15	10
139	857C	27R	1	116	120	285.26	490	1	1.5	ND	25	93	55	17	14
139	857C	27R	2	87	90	286.47	535	ND	ND	10	ND	110	60	ND	10
139	857C	28R	2	119	122	296.49	480	1	1.5	ND	26	81	61	16	17
139	857C	28R	3	27	29	297.07	487	ND	ND	9	ND	99	57	ND	10
139	857C	29R	1	58	61	303.98	470	ND	ND	16	ND	90	47	ND	10
139	857C	29R	ND	ND	ND	313.00	350	1	0.9	ND	5	46	17	10	10
139	857C	30R	1	116	120	314.26	500	1	1.2	ND	17	75	32	19	10
139	857C	30R	2	74	77	315.34	558	ND	ND	19	ND	99	35	ND	11
139	857C	30R	3	30	33	316.40	500	1	1.5	ND	24	86	56	16	10
139	857C	31R	1	121	123	323.91	570	1	1.5	ND	25	90	59	16	14
139	857C	31R	2	15	17	324.35	580	1	1.5	ND	25	92	58	16	16
139	857C	31R	2	102	105	325.22	616	ND	ND	10	ND	108	57	ND	10
139	857C	32R	1	34	37	327.94	530	1	1.4	ND	22	83	75	16	10
139	857C	33R	1	56	59	332.96	590	1	1.4	ND	24	86	54	16	13
139	857C	33R	2	71	73	334.61	609	ND	ND	11	ND	106	53	ND	10
139	857C	33R	3	65	68	336.05	600	1	1.4	ND	24	88	54	16	16
139	857C	34R	1	120	122	337.70	470	1	1.6	ND	24	71	36	28	18
139	857C	34R	3	44	47	339.94	550	1	1.7	ND	16	78	43	17	10
139	857C	35R	1	34	36	341.64	450	1	1.6	ND	18	91	36	19	12
139	857C	35R	1	124	127	342.54	488	ND	ND	20	ND	105	26	ND	12
139	857C	35R	5	31	33	344.50	490	1	2.1	ND	27	84	57	22	11
139	857C	36R	1	29	32	346.39	560	1	1.9	ND	25	76	66	19	20
139	857C	36R	1	79	81	348.89	590	1	2.0	ND	28	82	61	23	18
139	857C	36R	3	58	61	349.68	470	1	1.7	ND	25	100	65	20	17
139	857C	37R	1	115	119	351.95	430	1	1.6	ND	24	98	46	19	17
139	857C	37R	2	115	119	353.45	537	ND	ND	21	ND	118	47	ND	11
139	857C	37R	2	126	128	353.56	520	1	1.3	ND	23	86	40	18	19
139	857C	38R	2	50	53	357.80	570	1	1.2	ND	18	58	38	14	11
139	857C	38R	2	57	61	357.87	520	1	1.0	ND	19	56	37	15	14
139	857C	39R	1	66	68	361.06	580	1	1.4	ND	22	81	58	15	11
139	857C	39R	2	48	50	362.38	509	ND	ND	20	ND	113	52	ND	11
139	857C	39R	3	62	65	364.02	500	1	1.5	ND	15	79	51	20	17
139	857C	40R	2	30	35	367.20	520	1	1.6	ND	17	84	37	18	17
139	857C	41R	2	89	91	377.29	596	ND	ND	14	ND	113	47	ND	11
139	857C	41R	2	122	126	377.62	530	1	1.2	ND	15	78	31	16	14
139	857C	42R	1	82	84	380.52	510	1	1.3	ND	18	95	31	16	17
139	857C	42R	2	37	41	381.57	530	1	1.2	ND	16	79	37	15	16
139	857C	43R	1	130	134	386.00	510	1	1.4	ND	20	93	46	16	15
139	857C	43R	2	9	12	386.29	546	ND	ND	9	ND	115	50	ND	10
139	857C	43R	3	77	81	388.47	480	1	1.3	ND	19	93	42	16	10
139	857C	44R	1	137	140	391.07	450	1	1.1	ND	16	89	34	15	10
139	857C	44R	CC	12	16	392.76	490	1	1.4	ND	20	94	50	16	10
139	857C	45R	1	134	138	395.64	450	1	1.0	ND	17	84	24	15	15
139	857C	45R	2	42	44	396.22	494	ND	ND	9	ND	132	38	ND	10
139	857C	45R	2	79	81	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	857C	45R	2	81	83	396.59	500	1	1.2	ND	18	96	42	16	17
139	857C	46R	1	71	75	399.71	530	1	1.4	ND	21	110	34	17	19
139	857C	47R	1	56	59	404.56	510	1	1.3	ND	18	120	36	16	13
139	857C	47R	2	5	8	405.55	471	ND	ND	7	ND	124	39	ND	8
139	857C	48R	1	68	70	409.38	550	1	1.4	ND	24	110	49	15	12
139	857C	49R	2	45	47	415.65	408	ND	ND	0	ND	37	8	ND	4
139	857C	49R	2	74	77	415.94	530	1	1.3	ND	19	100	45	16	12

Table 1 (continued).

Ni	Pb	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As	Mo
parts per million													
61	10	90	17	230	130	19	1.80	100	110	0.95	0.40	5.9	1
49	ND	45	ND	344	151	21	ND	89	192	ND	ND	ND	ND
19	10	22	8.8	310	63	17	1.20	41	93	0.10	0.25	3.7	1
35	10	44	15	370	100	16	1.60	70	130	0.48	0.32	9.5	1
38	20	20	8.1	280	45	17	1.40	38	68	1.18	3.29	86.1	2
59	ND	62	ND	215	199	24	ND	114	140	ND	ND	ND	ND
27	10	30	11	200	72	17	1.20	50	65	3.14	0.44	9.1	1
23	10	30	14	440	95	18	1.60	54	120	1.55	0.30	2.7	1
39	10	42	18	360	130	19	1.80	82	130	1.74	0.24	7.7	1
59	ND	61	ND	219	190	22	ND	122	131	ND	ND	ND	ND
35	10	41	16	390	120	19	1.90	61	150	0.37	0.20	5.5	1
33	ND	41	ND	385	165	21	ND	84	167	ND	ND	ND	ND
27	10	43	16	460	130	19	1.80	67	120	1.11	0.10	4.3	1
48	ND	56	ND	272	186	22	ND	103	145	ND	ND	ND	ND
23	10	39	14	420	95	19	1.70	58	110	0.41	0.24	5.7	1
37	10	51	19	360	140	19	1.70	110	86	2.28	0.31	3.5	1
36	ND	36	ND	352	157	23	ND	63	202	ND	ND	ND	ND
49	ND	56	ND	234	165	24	ND	101	120	ND	ND	ND	ND
39	10	51	18	340	140	19	1.70	110	100	0.32	0.22	3.9	1
59	ND	63	ND	228	185	22	ND	121	138	ND	ND	ND	ND
52	10	60	19	280	140	21	1.90	110	110	1.16	0.28	5.5	1
40	10	51	18	280	140	18	1.60	110	97	2.64	0.27	5.3	1
47	0	57	ND	251	171	23	ND	100	163	ND	ND	ND	ND
41	10	50	17	280	120	20	1.90	78	130	1.61	0.10	6.7	1
41	ND	48	ND	252	156	23	ND	87	122	ND	ND	ND	ND
43	10	47	17	270	120	20	1.80	84	130	2.31	0.23	4.8	1
48	10	55	18	250	130	21	1.90	88	120	2.74	0.51	8.0	1
47	ND	49	ND	230	166	24	ND	102	159	ND	ND	ND	ND
22	10	29	11	180	66	15	1.10	47	60	0.20	0.27	3.5	1
40	10	47	16	200	110	18	1.60	78	98	1.77	0.38	8.2	1
81	31	55	21	190	140	21	2.00	120	110	3.64	1.50	35.7	6
74	10	61	21	200	150	22	2.10	100	110	3.85	0.48	8.3	1
60	ND	55	ND	189	191	24	ND	122	142	ND	ND	ND	ND
63	10	60	20	200	150	20	1.90	100	110	3.61	0.48	8.8	1
62	ND	64	ND	187	187	22	ND	125	141	ND	ND	ND	ND
63	10	56	21	180	140	22	2.10	110	110	4.35	0.53	6.5	1
55	ND	50	ND	168	184	24	ND	121	136	ND	ND	ND	ND
23	10	29	12	230	63	18	1.60	31	180	4.43	0.20	2.9	1
67	10	61	20	190	150	21	2.00	110	110	2.85	0.59	7.7	1
65	ND	58	ND	167	206	24	ND	141	136	ND	ND	ND	ND
61	10	56	21	200	140	22	2.10	110	110	3.01	0.51	5.7	1
52	ND	50	ND	185	188	25	ND	123	142	ND	ND	ND	ND
39	ND	40	ND	200	168	23	ND	86	164	ND	ND	ND	ND
14	10	21	9.2	270	56	13	1.00	27	110	0.30	0.27	4.0	1
40	10	45	15	240	100	20	1.90	65	170	1.02	0.60	12.7	2
46	ND	50	ND	208	163	25	ND	92	186	ND	ND	ND	ND
65	10	63	20	220	140	20	1.90	110	110	1.30	0.47	7.2	1
68	10	60	20	210	150	20	1.90	110	110	0.89	0.60	8.9	1
60	10	68	20	210	150	21	1.90	110	110	1.50	0.52	6.8	1
58	ND	61	ND	200	189	24	ND	117	137	ND	ND	ND	ND
53	10	52	19	230	130	20	1.90	86	120	1.32	0.38	6.1	1
54	10	61	20	230	140	21	2.10	92	110	0.80	0.36	4.4	1
61	ND	59	ND	196	189	23	ND	123	132	ND	ND	ND	ND
55	10	54	19	230	140	20	1.90	110	100	0.80	0.28	3.7	1
55	39	82	15	200	91	22	2.00	95	180	2.16	1.39	18.8	3
50	10	83	17	200	120	20	1.80	97	130	0.89	0.46	9.4	1
54	10	76	18	190	130	21	2.00	91	140	1.21	0.55	11.7	1
40	ND	59	ND	194	150	23	ND	75	193	ND	ND	ND	ND
80	10	88	21	150	150	25	2.30	120	170	0.83	0.35	4.5	1
73	10	84	18	160	130	24	2.20	100	180	0.88	0.29	3.0	1
87	21	90	19	160	140	23	2.10	130	180	0.81	0.57	4.9	1
86	10	70	18	200	140	20	1.90	84	140	0.76	0.27	3.4	1
81	10	67	18	190	140	19	1.80	92	130	0.41	0.34	8.0	1
66	ND	67	ND	176	163	22	ND	104	160	ND	ND	ND	ND
60	10	58	16	200	110	18	1.80	81	160	1.34	1.07	49.0	1
38	10	55	16	240	120	18	1.70	74	96	1.10	0.44	4.8	1
32	10	50	15	240	110	16	1.60	65	130	1.14	0.43	5.3	1
72	10	59	20	210	160	19	1.80	98	100	1.75	0.30	3.9	1
47	ND	57	ND	312	270	24	ND	81	161	ND	ND	ND	ND
43	10	66	17	200	130	19	1.90	90	130	0.84	0.28	3.8	1
61	10	65	19	180	150	21	2.00	77	120	2.09	0.47	6.8	1
54	ND	74	ND	161	213	24	ND	94	136	ND	ND	ND	ND
41	10	50	17	230	130	20	1.90	73	150	1.77	0.20	6.6	1
48	10	55	19	210	150	22	2.20	62	140	2.00	0.20	5.9	1
42	10	57	19	210	140	21	2.00	74	130	1.60	0.25	7.0	1
58	10	69	21	170	150	22	2.10	96	120	ND	ND	ND	ND
55	ND	69	ND	156	193	24	ND	107	137	ND	ND	ND	ND
50	10	65	19	180	150	20	2.00	84	120	1.20	0.44	9.5	1
44	10	53	18	210	130	20	2.00	65	140	2.42	0.37	7.0	1
61	10	63	21	180	150	21	2.00	95	110	0.59	0.34	5.3	1
41	10	45	16	240	110	19	1.80	59	140	1.59	0.33	8.7	1
67	ND	64	ND	166	206	24	ND	91	140	ND	ND	ND	ND
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
55	10	55	19	210	140	20	2.00	79	130	2.40	0.25	4.7	1
65	10	70	21	180	160	22	2.10	84	120	0.77	0.40	4.5	1
74	10	58	21	200	170	22	2.10	84	120	0.24	0.28	3.8	1
77	ND	53	ND	158	163	20	ND	84	122	ND	ND	ND	ND
91	10	60	21	190	160	21	2.00	100	110	2.36	0.36	5.4	1
9	ND	18	ND	277	105	13	ND	17	154	ND	ND	ND	ND
62	10	62	23	190	170	22	2.20	92	110	3.19	0.10	2.3	1

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Ba	Ag	Be	Ce	Co	Cr	Cu	La	Nb
									parts per million						
139	857C	50R	2	42	44	420.22	570	1	1.3	ND	19	90	37	15	11
139	857C	51R	1	28	30	423.68	570	ND	ND	7	ND	122	41	ND	10
139	857C	51R	2	12	15	425.02	450	1	1.1	ND	16	72	24	14	13
139	857C	53R	1	24	26	433.04	536	ND	ND	2	ND	116	51	ND	9
139	857C	53R	1	50	52	433.30	470	1	1.2	ND	19	90	45	15	14
139	857C	55R	1	17	20	442.17	300	1	1.2	ND	18	88	60	16	12
139	857C	55R	1	24	26	442.24	240	1	1.2	ND	17	79	85	15	12
139	857C	55R	1	25	27	442.25	181	ND	ND	8	ND	89	25	ND	7
139	857C	58R	1	16	17	461.66	230	1	1.2	ND	19	95	31	15	10
139	857C	61R	1	96	97	491.46	190	1	0.9	ND	48	350	190	10	14
139	857C	61R	1	113	115	491.63	281	ND	ND	13	ND	72	6	ND	7
139	857C	61R	1	129	131	491.79	30	1	0.7	ND	14	49	33	11	17
139	857C	63R	1	13	16	509.83	38	ND	ND	17	ND	90	9	ND	8
139	857C	65R	1	15	17	529.25	68	ND	ND	28	ND	85	8	ND	10
139	857C	66R	1	15	17	538.95	73	ND	ND	24	ND	94	28	ND	9
139	857C	66R	1	21	23	539.01	150	1	1.2	ND	31	190	260	18	19
139	857C	66R	1	89	91	539.69	60	1	1.0	ND	43	260	100	10	21
139	857C	67R	1	7	9	548.47	60	1	0.8	ND	9	62	32	14	13
139	857C	67R	1	55	57	548.95	54	ND	ND	24	ND	61	11	ND	6
139	857D	01R	1	128	130	582.78	7	ND	ND	7	ND	46	5	ND	5
139	857D	01R	1	137	139	582.87	30	1	0.6	ND	17	43	10	15	16
139	857D	01R	2	36	38	583.36	30	1	0.7	ND	20	48	10	11	17
139	857D	04R	2	75	77	611.15	30	1	0.8	ND	23	84	10	14	15
139	857D	05R	1	26	28	618.86	30	1	0.6	ND	23	55	34	11	13
139	857D	06R	1	20	22	628.10	30	1	0.5	ND	21	44	110	12	16
139	857D	11R	1	1	3	676.21	30	1	0.5	ND	8	50	10	14	14
139	857D	14R	1	22	25	705.00	110	1	1.3	ND	17	72	10	17	12
139	857D	15R	1	74	76	715.54	80	1	1.2	ND	19	73	10	17	17
139	857D	16R	1	53	55	725.03	80	1	1.2	ND	17	70	10	16	13
139	857D	17R	1	34	36	734.24	60	1	0.9	ND	14	50	10	13	11
139	857D	17R	1	146	148	735.36	130	1	1.5	ND	20	79	10	18	16
139	857D	17R	2	10	13	735.50	240	1	1.2	ND	21	81	10	18	13
139	857D	17R	2	53	55	735.93	90	1	0.8	ND	12	50	60	13	14
139	857D	17R	3	23	25	737.07	50	1	0.5	ND	5	36	10	10	12
139	857D	21R	1	140	143	773.60	140	1	1.2	ND	14	64	10	16	17
139	857D	21R	2	14	16	773.84	70	1	0.8	ND	12	60	10	15	12
139	857D	24R	1	40	42	801.60	70	1	0.8	ND	10	57	14	14	10
139	857D	28R	1	67	69	839.57	60	1	0.7	ND	13	59	10	11	11
139	857D	29R	1	11	12	848.51	70	1	0.6	ND	12	65	12	14	16
139	857D	30R	1	23	25	859.13	90	1	1.2	ND	15	77	10	16	13
139	857D	31R	1	35	37	868.85	60	1	0.7	ND	14	56	10	14	13
139	857D	34R	1	87	89	898.37	30	1	0.7	ND	10	47	10	13	15
139	857D	37R	1	21	23	926.71	26	ND	ND	8	ND	66	10	ND	5
139	857D	37R	1	38	40	926.88	50	1	0.7	ND	9	39	10	11	12
139	858A	01H	1	76	78	0.76	770	1	1.6	ND	18	59	43	20	15
139	858A	01H	1	81	83	0.81	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	01H	2	5	7	1.55	610	1	2.1	ND	17	53	33	29	19
139	858A	01H	2	32	34	1.82	600	1	1.4	ND	21	76	47	18	13
139	858A	02H	1	34	36	2.74	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	02H	1	125	127	3.65	740	1	1.3	ND	21	68	51	17	11
139	858A	02H	3	27	31	5.67	2300	1	1.4	ND	16	72	53	18	10
139	858A	02H	3	49	52	5.89	940	1	1.6	ND	14	70	45	19	10
139	858A	02H	3	89	93	6.29	1000	1	1.5	ND	16	71	47	18	10
139	858A	02H	3	127	129	6.67	660	1	1.7	ND	19	78	52	22	17
139	858A	02H	5	40	44	8.80	870	1	1.3	ND	24	85	57	17	10
139	858A	02H	5	59	63	8.99	610	1	1.5	ND	24	84	64	19	10
139	858A	02H	5	80	81	9.20	650	1	1.7	ND	19	81	49	24	14
139	858A	02H	5	93	96	9.33	630	1	1.4	ND	24	85	58	17	12
139	858A	02H	6	99	100	10.89	11000	1	0.9	ND	5	35	18	11	10
139	858A	02H	7	30	31	11.70	1900	1	0.7	ND	5	21	11	10	10
139	858A	02H	7	59	61	11.97	560	1	1.5	ND	17	79	47	20	13
139	858A	02H	CC	113	114	12.00	530	1	0.9	ND	5	39	22	13	10
139	858A	03H	1	108	110	12.98	600	1	1.1	ND	10	54	36	11	10
139	858A	03H	2	44	48	13.61	620	1	1.5	ND	17	72	43	20	11
139	858A	03H	3	81	85	15.48	705	ND	ND	22	ND	101	51	ND	12
139	858A	03H	3	85	87	15.52	620	1	1.7	ND	17	79	39	25	14
139	858A	03H	4	29	33	16.46	600	1	1.6	ND	18	76	40	23	12
139	858A	03H	6	43	47	19.60	500	1	1.4	ND	16	78	39	20	15
139	858A	03H	6	50	51	19.67	30	1	1.1	ND	7	56	20	20	ND
139	858A	03H	6	87	90	20.04	600	ND	1.5	ND	16	81	40	20	13
139	858A	03H	CC	1	3	21.33	600	1	1.5	ND	17	81	35	29	10
139	858A	04H	2	66	70	23.56	680	1	1.7	ND	19	80	44	23	14
139	858A	04H	2	76	80	23.66	700	1	1.8	ND	24	84	44	22	11
139	858A	04H	2	79	83	23.69	743	ND	ND	22	ND	107	51	ND	14
139	858A	04H	2	96	100	23.86	530	1	1.4	ND	18	71	32	28	12
139	858A	04H	4	46	50	26.36	560	1	1.5	ND	18	72	45	18	10
139	858A	04H	4	103	107	26.93	610	1	1.6	ND	18	77	38	16	13
139	858A	04H	5	102	106	28.42	560	1	1.6	ND	18	76	41	20	18
139	858A	04H	6	48	50	29.38	660	1	1.6	ND	18	88	41	21	10
139	858A	04H	6	65	69	29.55	660	1	1.7	ND	19	76	43	18	15
139	858A	04H	6	87	89	29.77	600	1	1.6	ND	17	79	41	21	10
139	858A	05H	3	98	102	34.88	710	1	1.6	ND	25	76	45	18	15
139	858A	05H	1	57	61	31.47	700	1	1.6	ND	20	85	37	23	16
139	858A	05H	2	2	4	32.42	280	1	1.0	ND	5	28	10	25	11
139	858A	05H	2	134	137	33.74	590	1	1.0	ND	11	76	39	23	18
139	858A	05H	3	100	105	34.90	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	05H	3	71	75	34.61	680	1	1.5	ND	22	84	41	17	15
139	858A	05H	4	27	30	35.67	610	1	1.1	ND	17	77	29	32	13
139	858A	05H	5	54	57	37.44	640	1	1.3	ND	18	81	28	18	14
139	858A	05H	6	40	45	38.80	450	1	1.2	ND	8	51	24	17	12

Table 1 (continued).

Ni	Pb	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As	Mo
parts per million													
56	10	57	21	240	160	21	2.00	82	110	3.14	0.23	3.8	1
57	ND	52	ND	201	197	25	ND	90	150	ND	ND	ND	ND
31	10	24	16	320	120	18	1.90	50	160	0.86	0.10	4.4	1
63	ND	48	ND	229	206	25	ND	106	146	ND	ND	ND	ND
57	10	44	21	280	150	22	2.10	83	120	1.98	0.21	4.3	1
51	10	24	19	330	140	21	2.10	73	140	1.02	0.24	5.1	1
39	21	22	17	360	120	20	2.00	72	150	0.71	0.25	5.1	1
34	ND	13	ND	296	130	24	ND	52	178	ND	ND	ND	ND
53	10	23	22	300	160	21	2.00	96	120	3.56	0.10	3.3	1
88	10	15	47	290	260	32	3.30	96	120	7.37	0.10	0.6	1
21	ND	4	ND	359	107	18	ND	49	223	ND	ND	ND	ND
21	10	10	14	150	100	12	1.20	86	120	1.76	0.23	1.5	1
38	ND	1	ND	408	177	23	ND	66	178	ND	ND	ND	ND
38	ND	1	ND	341	144	23	ND	51	211	ND	ND	ND	ND
42	ND	1	ND	341	173	22	ND	91	185	ND	ND	ND	ND
84	10	10	32	290	210	34	3.10	190	180	6.36	0.10	0.8	3
130	10	10	36	150	280	34	3.00	890	160	5.84	0.27	8.0	1
21	10	10	12	330	88	15	1.60	120	160	0.40	0.10	0.4	1
16	ND	1	ND	154	105	14	ND	63	155	ND	ND	ND	ND
21	ND	0	ND	57	93	14	ND	57	100	ND	ND	ND	ND
24	10	10	10	72	82	14	1.20	62	91	1.15	0.10	0.1	1
30	10	10	12	120	99	14	1.30	67	70	0.70	0.10	0.1	1
49	10	10	19	250	140	19	1.90	71	110	1.21	0.10	0.3	1
31	10	10	15	350	130	16	1.50	36	85	4.85	0.10	0.5	1
21	10	10	12	110	90	14	1.30	41	100	3.76	0.10	0.2	1
18	10	10	10	270	74	14	1.50	26	160	0.24	0.10	0.3	1
36	10	10	18	370	140	21	2.00	55	130	1.09	0.25	0.3	1
40	10	10	17	310	140	21	2.00	64	130	2.96	0.10	1.1	1
37	10	10	18	320	130	20	2.00	69	130	0.30	0.10	1.2	1
28	10	10	12	380	89	15	1.40	29	140	1.60	0.10	1.1	1
46	10	10	19	340	150	21	2.00	75	120	0.62	0.10	0.3	1
45	10	10	18	350	130	21	2.20	64	140	0.90	0.10	0.9	1
26	10	10	10	290	74	14	1.40	25	140	2.59	0.10	1.0	1
14	10	10	8.6	310	56	12	1.20	20	110	0.25	0.10	0.2	1
33	10	10	17	300	120	21	1.90	54	140	0.32	0.10	0.3	1
26	10	10	14	300	100	17	1.70	37	160	0.21	0.10	0.6	1
23	10	10	14	330	110	16	1.60	41	170	0.49	0.10	0.5	1
21	10	10	15	340	110	17	1.80	47	150	0.48	0.10	0.3	1
27	10	10	16	220	110	16	1.70	43	170	0.63	0.10	0.4	1
35	10	10	20	380	140	20	1.90	80	130	1.48	0.10	0.2	1
27	10	10	15	180	98	18	1.80	43	150	0.65	0.10	0.3	1
23	20	10	15	410	94	18	1.60	42	140	0.20	0.10	0.3	1
20	ND	1	ND	359	143	18	ND	23	157	ND	ND	ND	ND
14	10	10	13	420	99	15	1.50	27	110	1.63	0.10	0.2	1
36	23	96	15	420	110	21	2.00	87	140	1.62	1.26	4.4	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
27	23	120	16	240	110	27	2.50	87	170	0.63	0.79	6.3	1
42	20	70	18	290	130	21	2.00	85	130	0.56	0.46	9.0	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
42	20	73	17	380	130	19	1.80	94	120	0.89	0.62	4.5	1
45	20	72	15	460	120	19	1.80	100	100	1.67	0.85	3.2	1
43	20	100	14	440	100	18	1.80	92	110	1.36	0.73	2.8	1
50	20	80	14	400	110	17	1.60	100	100	2.04	0.98	3.4	1
46	20	99	17	310	120	20	1.90	100	120	0.82	0.49	5.5	1
60	20	69	18	330	140	20	1.90	94	110	1.30	0.77	14.5	2
55	20	75	17	350	130	20	2.00	100	110	1.25	0.73	7.6	1
42	20	93	16	310	140	19	1.70	100	130	1.11	0.69	5.9	1
53	20	78	19	310	140	20	1.90	100	110	1.65	0.62	8.3	1
10	20	25	7.6	510	56	14	1.00	37	54	0.56	0.42	4.4	6
10	20	26	4.5	280	32	7	0.50	15	30	0.25	0.27	1.4	2
51	20	77	18	290	130	20	2.00	86	120	0.91	0.51	6.9	1
11	20	23	7.2	400	57	17	1.30	44	57	0.31	0.38	1.8	1
26	20	26	13	450	98	15	1.30	63	82	0.73	0.39	5.1	4
42	20	85	15	340	110	19	1.90	93	120	1.60	0.55	9.6	1
48	ND	98	ND	303	160	23	ND	117	173	ND	ND	ND	ND
40	20	100	15	300	120	19	1.80	89	140	1.22	0.50	6.4	1
43	20	92	15	340	130	19	1.80	97	150	1.14	0.79	7.2	1
42	20	82	15	310	120	19	1.80	83	160	1.24	0.64	5.3	1
40	20	ND	11	250	74	22	1.70	52	120	0.20	0.40	1.6	1
43	20	83	16	290	120	17	1.70	87	160	0.96	0.60	6.7	1
45	20	86	14	280	100	22	2.20	85	190	1.06	0.88	8.3	1
54	20	130	15	230	110	18	1.80	92	120	0.50	0.33	2.3	1
62	22	140	15	190	120	18	1.70	110	130	1.37	1.03	33.9	1
67	ND	133	ND	212	146	22	ND	114	154	ND	ND	ND	ND
44	20	77	12	270	87	20	2.00	83	190	0.64	0.41	4.9	1
47	20	110	17	210	120	19	2.00	120	130	1.45	0.28	2.6	1
49	20	120	16	170	130	17	1.70	97	140	1.88	0.62	5.3	1
51	20	110	15	210	110	18	1.80	91	150	1.23	0.54	4.8	1
58	20	120	15	190	120	20	2.00	94	140	1.30	0.44	5.8	1
51	20	130	17	190	130	17	1.70	100	130	1.22	0.66	8.4	1
46	20	120	15	180	120	22	2.00	96	120	1.06	0.51	6.8	1
66	20	130	17	150	130	21	1.80	120	130	0.31	0.35	2.3	1
50	21	120	15	200	120	18	1.90	95	160	1.18	0.48	4.8	1
10	20	48	6.2	170	42	35	1.90	30	46	0.25	0.10	1.9	1
35	20	73	12	300	86	24	2.20	65	170	0.10	0.43	5.9	2
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
53	20	110	17	160	130	17	1.70	100	140	1.55	0.35	4.5	1
40	20	77	13	240	90	32	2.60	69	160	0.48	0.62	28.2	1
48	20	99	14	200	110	18	1.70	88	160	0.41	0.65	15.2	1
31	20	73	10	180	66	18	1.50	66	69	0.33	0.37	4.2	1

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Ba	Ag	Be	Ce	Co	Cr	Cu	La	Nb
									parts per million						
139	858A	05H	6	76	80	39.16	780	1	1.5	ND	21	74	41	19	16
139	858A	05H	CC	10	11	40.00	330	1	1.1	ND	5	36	15	16	13
139	858A	06H	1	74	76	41.14	770	1	1.4	ND	21	86	41	18	14
139	858A	06H	1	114	117	41.54	710	1	1.5	ND	22	80	46	13	17
139	858A	06H	2	94	96	42.84	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	06H	3	77	79	44.17	660	1	1.3	ND	20	86	39	18	12
139	858A	06H	3	88	91	44.28	670	1	1.4	ND	23	82	45	17	17
139	858A	07H	1	77	80	50.67	710	1	1.2	ND	17	95	27	20	14
139	858A	07H	2	63	66	52.03	680	1	1.4	ND	20	99	32	18	16
139	858A	07H	4	83	86	55.23	780	1	1.0	ND	20	77	17	18	10
139	858A	07H	4	88	91	55.28	730	1	1.0	ND	16	88	24	18	13
139	858A	07H	4	93	97	55.33	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	07H	5	54	57	56.44	730	1	1.5	ND	23	90	42	19	12
139	858A	07H	6	67	71	58.07	770	1	1.2	ND	17	87	24	17	14
139	858A	08H	1	28	30	59.18	780	1	1.1	ND	16	87	16	16	11
139	858A	08H	2	31	33	60.64	720	1	1.1	ND	17	83	27	16	16
139	858A	08H	2	39	41	60.72	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	08H	2	89	91	61.22	740	1	1.4	ND	22	88	36	18	16
139	858A	09X	1	92	95	63.42	780	1	1.5	ND	22	94	48	20	16
139	858A	09X	2	38	40	64.38	670	1	1.4	ND	21	110	38	18	15
139	858A	09X	2	114	116	65.14	790	1	1.3	ND	18	99	35	19	11
139	858A	09X	3	108	112	66.58	780	1	1.1	ND	14	85	25	19	32
139	858A	09X	4	47	51	67.47	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	09X	4	52	56	67.52	730	1	1.4	ND	20	96	41	19	26
139	858A	09X	5	36	40	68.86	720	1	1.6	ND	21	88	49	18	20
139	858A	09X	6	110	114	71.10	620	1	1.3	ND	13	63	37	16	13
139	858A	09X	6	129	133	71.29	580	1	1.3	ND	20	82	44	16	16
139	858A	11X	1	2	7	72.92	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	11X	CC	10	12	73.57	620	1	1.0	ND	18	90	30	16	13
139	858A	11X	CC	17	21	73.64	570	1	1.1	ND	17	87	35	16	16
139	858A	12X	1	18	20	81.78	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	12X	CC	11	13	81.91	130	1	0.8	ND	5	17	10	12	10
139	858A	14X	CC	11	13	101.11	470	1	1.1	ND	17	83	41	13	16
139	858A	15X	1	35	37	110.95	1400	1	0.9	ND	15	67	26	15	11
139	858A	15X	1	60	62	111.20	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	16X	1	3	5	120.33	310	1	1.2	ND	18	75	48	14	10
139	858A	16X	1	38	40	120.68	300	1	1.3	ND	19	81	44	18	11
139	858A	18X	1	116	118	140.76	230	1	1.2	ND	13	60	70	14	15
139	858A	18X	2	109	111	142.19	340	1	1.2	ND	25	76	50	11	19
139	858A	18X	3	14	16	142.74	270	1	1.3	ND	19	74	43	13	16
139	858A	18X	3	16	20	142.76	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858A	19X	1	28	30	149.58	290	1	1.3	ND	18	74	34	19	20
139	858A	20X	1	62	64	159.62	330	1	1.3	ND	19	80	33	10	10
139	858A	20X	1	128	130	160.28	360	1	1.3	ND	22	67	26	13	20
139	858A	20X	3	39	41	162.32	200	1	0.9	ND	15	67	11	12	14
139	858A	20X	4	100	103	164.44	300	1	1.4	ND	21	73	26	16	18
139	858A	21X	1	117	120	169.77	360	1	1.5	ND	18	77	32	16	19
139	858A	21X	2	31	34	170.41	280	1	1.3	ND	19	82	33	10	20
139	858A	21X	3	57	59	171.98	240	1	1.2	ND	23	76	37	16	18
139	858A	23X	1	73	75	188.63	210	1	0.9	ND	13	70	22	21	17
139	858A	23X	1	113	115	189.03	260	1	1.5	ND	18	75	29	12	22
139	858A	24X	1	33	35	197.93	380	1	2.1	ND	11	75	38	17	17
139	858A	24X	1	72	74	198.32	320	1	1.4	ND	26	76	45	10	17
139	858A	25X	1	29	32	207.59	350	1	1.6	ND	22	88	58	22	21
139	858A	26X	CC	4	6	216.94	340	1	1.5	ND	25	88	40	16	16
139	858A	27X	1	33	35	226.93	170	ND	1.1	ND	16	77	240	13	21
139	858A	28X	CC	4	5	236.24	200	1	0.9	ND	16	90	25	17	13
139	858A	29X	1	30	32	246.20	140	1	0.8	ND	10	36	63	17	11
139	858A	30X	1	4	8	255.64	200	1	1.2	ND	28	76	20	12	14
139	858A	30X	1	67	70	256.27	200	1	1.2	ND	23	76	27	15	18
139	858A	31X	1	65	67	265.95	230	1	1.4	ND	23	86	44	15	20
139	858A	35X	0	5	6	301.45	100	1	1.2	ND	13	67	10	18	16
139	858B	01H	2	21	23	1.71	360	1	1.2	ND	11	17	5100	10	10
139	858B	01H	2	42	46	1.92	194	ND	ND	ND	ND	26	4249	ND	3
139	858B	01H	2	50	54	2.00	520	1	1.5	ND	23	75	120	19	10
139	858B	01H	3	23	27	3.23	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858B	01H	4	67	71	5.17	760	1	1.5	ND	21	64	340	18	13
139	858B	01H	5	14	18	6.14	880	1	1.6	ND	21	70	180	19	16
139	858B	01H	5	21	25	6.21	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858B	01H	CC	8	12	6.98	5200	1	1.4	ND	23	85	53	18	10
139	858B	02H	1	73	76	7.93	800	1	1.2	ND	23	100	60	15	15
139	858B	02H	2	89	91	9.59	690	1	1.3	ND	23	67	56	16	11
139	858B	02H	2	121	124	9.91	690	1	1.4	ND	20	71	85	18	12
139	858B	02H	2	125	127	9.95	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858B	02H	3	50	52	10.70	30	6	0.5	ND	5	10	3500	10	ND
139	858B	02H	3	84	86	11.04	30	13	0.5	ND	5	10	3900	10	ND
139	858B	02H	3	113	115	11.33	30	1	0.6	ND	5	18	57	10	ND
139	858B	02H	4	43	45	12.13	2000	13	0.5	ND	71	10	5900	10	ND
139	858B	02H	4	62	64	12.32	30	4	0.5	ND	13	23	3500	10	ND
139	858B	02H	4	94	96	12.64	1500	1	0.7	ND	14	44	1300	10	ND
139	858B	02H	5	11	13	13.31	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858B	02H	5	16	18	13.36	280	1	1.1	ND	15	58	98	10	14
139	858B	02H	5	35	37	13.55	270	1	1.1	ND	14	53	340	12	10
139	858B	02H	6	69	71	15.39	300	1	1.1	ND	19	68	48	10	18
139	858B	02H	6	75	77	15.45	260	1	1.1	ND	19	60	42	11	16
139	858B	05H	1	117	121	25.07	110	1	0.5	ND	11	64	120	26	17
139	858B	05H	1	122	125	25.12	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858B	05H	1	140	143	25.30	70	1	0.5	ND	8	63	10	10	20
139	858B	05H	3	21	24	27.11	30	1	0.5	ND	14	54	10	10	16
139	858B	05H	3	118	121	28.08	30	1	0.7	ND	15	65	10	17	18

Table 1 (continued).

Ni	Pb	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As	Mo
parts per million													
58	20	130	15	160	120	17	1.60	95	130	0.52	0.63	9.3	1
21	20	58	7.2	190	49	18	1.40	40	46	0.44	0.34	2.4	1
58	20	120	17	140	120	17	1.70	100	130	0.23	0.10	2.7	1
59	20	120	18	130	130	18	1.70	120	110	0.73	0.59	26.1	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
49	20	110	17	150	120	17	1.70	96	160	0.66	0.45	6.6	1
59	20	120	17	130	130	17	1.60	110	140	0.54	0.85	13.6	1
45	20	100	15	180	110	20	2.00	78	190	0.31	0.50	2.7	1
59	20	120	15	140	120	16	1.60	150	170	0.29	0.32	4.8	1
49	20	82	11	220	78	16	1.60	60	130	0.10	0.31	3.0	1
44	20	75	12	230	83	16	1.60	58	190	0.20	0.40	3.3	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
65	20	110	17	130	130	17	1.60	110	120	0.75	0.37	2.7	1
53	20	100	14	190	110	16	1.60	82	160	0.41	0.30	2.8	1
39	20	87	13	220	120	15	1.50	68	190	0.10	0.28	4.3	1
37	20	85	14	210	110	17	1.70	73	160	0.30	0.31	4.5	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
49	20	110	17	150	130	17	1.60	100	130	0.26	0.10	2.5	1
63	20	120	16	120	120	19	1.80	100	130	0.45	0.28	2.4	1
58	20	98	17	140	130	18	1.80	97	140	0.10	0.10	3.3	1
50	20	96	14	160	110	19	1.80	85	150	0.60	0.31	5.0	1
39	20	81	12	210	82	20	1.70	66	330	0.31	0.53	3.9	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
58	20	120	15	150	120	19	1.80	110	260	0.20	0.10	2.2	1
55	20	110	18	110	140	19	1.90	110	120	0.46	0.29	2.1	1
26	20	83	13	310	100	18	1.70	76	110	0.34	0.10	2.9	1
45	20	92	19	150	140	19	1.80	93	120	0.24	0.10	4.6	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
42	20	73	16	170	110	18	1.90	71	170	0.48	0.44	3.5	1
45	20	85	16	150	120	20	2.00	74	140	0.10	0.20	2.0	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10	20	11	3.3	320	21	17	0.50	16	20	0.10	0.10	1.0	1
54	20	71	17	120	130	18	1.70	85	120	0.29	0.30	3.1	1
38	20	56	16	150	110	17	1.70	62	160	0.43	0.43	5.3	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
49	20	53	19	130	140	21	1.90	87	110	2.21	0.44	5.8	1
55	20	50	19	260	150	19	1.90	94	89	0.33	0.24	3.1	1
61	20	42	16	130	130	23	2.00	85	110	0.67	0.10	0.8	1
62	20	63	19	100	150	22	2.10	110	120	1.19	0.10	4.9	1
62	20	46	20	92	160	24	2.20	100	110	1.27	0.10	2.0	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
60	20	48	20	75	160	17	1.60	110	110	1.59	0.10	1.0	1
66	20	49	19	71	140	13	1.40	93	120	1.17	0.42	1.5	1
66	20	50	19	61	140	14	1.50	99	110	0.21	0.10	2.7	1
36	20	30	13	210	100	13	1.20	62	150	0.20	0.10	2.1	1
55	20	49	19	96	150	14	1.40	99	120	0.56	0.10	1.4	1
50	20	59	19	75	160	11	1.10	99	110	0.74	0.10	2.4	1
46	20	49	17	100	130	19	1.60	89	140	0.91	0.10	3.8	1
47	48	33	17	130	120	17	1.90	110	180	0.57	0.10	2.7	1
39	20	19	13	110	85	13	1.20	61	160	0.42	0.21	6.1	1
42	20	35	20	100	160	18	1.70	140	140	0.57	0.10	3.1	1
39	20	58	15	120	130	17	1.70	150	150	0.51	0.10	0.9	1
64	20	37	20	99	160	14	1.50	130	100	1.12	0.33	6.5	1
62	20	44	18	110	140	20	1.90	110	140	1.19	0.23	4.5	1
75	20	46	19	120	150	20	2.00	110	130	1.48	0.69	15.4	1
39	20	26	16	180	120	17	1.90	86	150	0.58	0.42	7.8	1
37	24	32	15	200	110	19	1.70	120	120	0.38	0.22	5.4	7
19	20	11	10	360	81	13	1.30	50	130	0.62	0.10	4.1	1
55	20	38	20	130	160	16	1.70	100	98	1.65	0.39	9.3	1
47	20	38	20	120	150	17	1.70	96	100	1.03	0.43	13.2	1
59	20	47	20	110	150	18	1.70	110	110	1.63	0.10	3.1	1
30	20	10	13	210	84	18	1.80	77	170	0.25	0.23	1.8	1
18	290	34	2.4	140	50	5	0.50	3200	13	ND	ND	ND	1
27	ND	22	ND	141	87	ND	ND	1813	47	ND	ND	ND	ND
72	37	59	15	360	120	20	1.90	170	99	2.96	1.49	66.1	2
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
29	82	66	15	260	120	20	1.90	200	120	3.36	1.08	4.4	1
41	35	76	17	210	120	20	2.10	130	120	1.72	0.26	1.7	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10	20	84	17	300	130	20	2.00	100	140	2.28	0.95	17.6	25
58	20	63	17	190	130	19	1.70	100	120	1.95	0.77	9.5	4
45	20	81	18	260	130	19	2.00	120	100	0.50	0.46	5.1	1
44	26	70	15	200	120	18	1.60	170	110	0.51	0.10	2.1	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
10	210	ND	0.6	25	5	5	0.50	35000	10	163.12	5.57	37.3	1
14	610	ND	1.2	20	5	5	0.50	27000	10	96.34	19.91	155.7	18
10	59	ND	4.9	930	33	5	0.50	140	36	4.01	0.46	6.8	1
10	310	ND	1.6	110	21	5	0.50	12000	10	176.14	9.50	118.8	8
17	350	ND	3.6	640	93	5	0.50	5500	21	47.40	2.50	28.9	3
10	320	ND	8.3	73	87	8	0.50	4000	60	32.76	1.64	12.3	3
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
41	36	42	13	130	110	9	0.90	270	92	4.53	1.56	16.6	1
41	45	49	10	110	83	11	1.10	310	75	5.14	1.68	17.7	5
46	20	54	16	88	120	12	1.30	120	100	1.20	1.07	14.2	1
52	20	49	16	81	130	11	1.30	150	96	1.14	0.89	12.4	3
84	31	12	11	75	110	18	1.70	820	120	4.43	0.44	12.6	31
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
40	20	10	10	67	120	10	0.90	30	120	0.10	0.10	4.3	19
39	20	10	9.1	36	87	8	0.60	58	95	0.63	0.10	5.3	26
46	20	10	11	47	97	13	1.10	68	130	0.86	0.29	12.6	3

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Ba	Ag	Be	Ce	Co	Cr	Cu	La	Nb
									parts per million						
139	858B	05H	3	124	128	28.14	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858B	05H	4	27	29	28.67	60	1	1.1	ND	14	86	10	20	19
139	858B	05H	4	33	37	28.73	30	1	0.5	ND	6	22	10	10	13
139	858C	01H	1	52	56	0.52	1900	1	1.4	ND	17	65	55	17	10
139	858C	01H	2	38	42	1.88	610	1	2.3	ND	19	53	37	32	19
139	858C	01H	2	42	46	1.92	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858C	01H	3	17	21	3.17	520	1	2.0	ND	23	60	48	27	16
139	858C	02H	1	88	91	4.38	530	1	1.4	ND	25	79	61	18	10
139	858C	02H	2	15	17	5.15	8500	1	1.5	ND	23	74	53	19	10
139	858C	02H	2	77	79	5.77	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858C	02H	4	15	17	8.15	530	1	1.5	ND	18	76	56	18	14
139	858C	02H	4	72	75	8.72	1300	1	1.5	ND	17	68	46	19	10
139	858C	02H	5	32	34	9.82	21000	1	0.9	ND	6	40	24	10	10
139	858C	02H	6	78	81	11.78	800	1	1.5	ND	28	81	69	20	10
139	858C	02H	6	110	112	12.10	1200	1	1.4	ND	25	92	54	20	10
139	858C	02H	7	15	17	12.65	900	1	1.5	ND	29	86	57	23	10
139	858C	03H	1	0	0	14.00	2000	1	1.5	ND	25	85	60	14	10
139	858C	03H	1	24	26	13.24	780	1	1.4	ND	9	45	40	19	10
139	858C	03H	1	29	30	13.29	3500	1	0.7	ND	5	14	13	10	10
139	858C	03H	1	49	51	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858C	03H	1	78	81	13.78	260	1	1.1	ND	5	24	15	10	10
139	858C	03H	1	108	110	14.08	1000	1	1.9	ND	18	84	53	14	10
139	858C	03H	1	145	150	14.45	460	1	1.2	ND	5	34	23	11	10
139	858C	03H	2	10	15	14.60	470	1	1.3	ND	5	35	17	12	10
139	858C	03H	2	36	38	14.86	220	1	1.2	ND	5	29	21	10	10
139	858C	03H	2	54	57	15.04	170	1	1.2	ND	5	30	21	10	10
139	858C	03H	2	110	115	15.60	120	1	1.2	ND	5	19	12	10	10
139	858C	03H	2	124	126	15.74	210	1	1.5	ND	5	32	25	11	10
139	858C	03H	2	133	135	15.83	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858C	03H	2	136	139	15.86	1300	1	1.3	ND	15	65	48	16	10
139	858C	03H	3	2	4	16.02	1400	1	0.9	ND	11	54	31	11	10
139	858C	03H	3	22	24	16.22	1300	1	0.9	ND	5	36	42	10	10
139	858C	03H	3	38	41	16.38	790	1	1.1	ND	5	21	26	29	10
139	858C	03H	3	68	70	16.68	3400	1	1.1	ND	13	52	140	10	10
139	858C	03H	3	78	80	16.78	740	1	1.4	ND	5	22	24	30	10
139	858C	03H	3	107	109	17.07	3400	1	1.2	ND	16	63	81	10	10
139	858C	03H	3	122	124	17.22	2800	1	1.1	ND	11	53	63	10	10
139	858C	03H	4	77	80	18.27	1100	1	1.6	ND	15	61	41	14	10
139	858C	03H	5	58	60	19.58	1100	1	1.4	ND	17	76	51	18	15
139	858C	03H	6	86	89	21.36	1500	1	1.2	ND	18	81	47	14	10
139	858C	03H	6	86	89	21.36	1500	1	1.2	ND	18	81	47	14	10
139	858C	03H	7	6	9	22.06	1400	1	1.1	ND	15	74	39	16	10
139	858C	05H	1	72	75	24.22	850	1	1.2	ND	15	72	38	23	15
139	858C	05H	1	122	124	24.72	440	1	1.4	ND	17	80	29	34	15
139	858C	05H	2	18	20	25.18	330	1	1.8	ND	29	85	60	22	ND
139	858C	05H	2	106	108	26.06	830	1	1.7	ND	25	81	36	22	13
139	858C	05H	2	122	123	26.22	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858C	05H	3	5	7	26.55	730	1	1.5	ND	19	70	32	22	14
139	858C	05H	3	19	21	26.69	960	1	1.8	ND	18	92	50	22	19
139	858C	05H	3	61	63	27.11	710	1	1.5	ND	19	70	30	28	17
139	858C	05H	4	27	28	28.27	640	1	0.9	ND	8	39	17	23	11
139	858C	05H	4	55	57	28.55	1800	1	1.2	ND	20	73	38	17	12
139	858C	05H	4	93	95	28.93	1400	1	1.4	ND	19	73	49	17	12
139	858C	05H	5	21	23	29.71	1700	1	1.1	ND	15	77	26	20	11
139	858C	05H	5	88	90	30.38	1300	1	1.2	ND	19	83	35	20	15
139	858C	05H	CC	7	10	33.20	2100	1	0.9	ND	16	110	26	23	10
139	858C	06H	1	19	21	33.19	1300	1	1.2	ND	17	93	26	22	10
139	858C	06H	1	80	82	33.80	1100	1	1.3	ND	18	82	18	20	14
139	858C	06H	1	123	125	34.23	1000	1	1.3	ND	30	74	40	19	ND
139	858C	06H	2	75	77	35.25	1100	1	1.3	ND	22	88	29	22	15
139	858C	06H	2	135	137	35.85	360	1	1.6	ND	20	70	46	14	15
139	858C	06H	3	51	53	36.51	600	1	1.5	ND	23	83	41	20	17
139	858C	06H	3	104	106	37.04	790	ND	ND	9	ND	102	55	ND	11
139	858C	06H	3	108	110	37.08	490	1	1.5	ND	23	83	56	17	17
139	858C	06H	4	43	51	37.93	140	1	0.8	ND	5	24	10	48	ND
139	858C	06H	5	45	48	39.45	1100	1	1.2	ND	27	79	23	18	10
139	858C	06H	5	76	79	39.76	640	1	1.4	ND	19	80	35	16	16
139	858C	06H	6	52	55	41.02	230	1	0.7	ND	5	32	15	15	10
139	858C	07H	1	11	12	41.61	380	1	1.6	ND	18	80	31	17	11
139	858C	07H	1	90	92	42.40	950	1	0.9	ND	21	80	17	17	15
139	858C	07H	2	53	55	43.53	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858C	07H	2	55	58	43.55	260	1	1.4	ND	19	88	36	19	20
139	858C	07H	2	60	64	43.60	1300	1	1.6	ND	26	100	30	21	13
139	858C	07H	2	143	146	44.43	240	1	1.4	ND	19	82	67	20	17
139	858C	10X	CC	2	4	49.52	120	1	1.2	ND	16	76	35	16	16
139	858C	10X	CC	37	39	49.87	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858C	11X	1	33	35	54.83	180	1	1.2	ND	23	85	28	14	14
139	858C	11X	1	48	51	54.98	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858C	12X	1	42	45	64.20	140	1	0.9	ND	16	84	31	16	18
139	858C	12X	2	80	82	66.30	100	1	1.6	ND	23	91	57	20	18
139	858C	12X	3	87	90	67.87	661	ND	ND	25	ND	107	87	ND	10
139	858C	12X	CC	8	10	68.14	120	1	0.6	ND	14	92	41	19	16
139	858C	13X	1	1	16	73.71	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858C	13X	1	25	28	73.95	80	1	1.5	ND	19	96	64	16	18
139	858C	14X	1	34	36	83.74	141	ND	ND	16	ND	98	57	ND	10
139	858C	14X	1	49	51	ND	150	1	1.4	ND	20	80	32	18	13
139	858D	01H	1	105	107	1.05	500	1	1.4	ND	27	74	67	17	10
139	858D	01H	1	115	119	1.15	650	1	1.7	ND	20	69	50	21	12
139	858D	01H	3	27	31	3.27	660	1	2.0	ND	16	53	32	29	18
139	858D	01H	3	98	102	3.98	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 1 (continued).

Ni	Pb	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As	Mo
parts per million													
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
59	20	10	14	42	110	20	1.70	60	150	1.47	0.30	2.9	11
19	20	10	3.6	27	31	6	0.50	52	32	0.23	0.10	0.1	1
46	20	68	14	390	120	17	1.70	120	95	1.92	0.87	5.2	8
36	30	120	17	240	120	26	2.70	120	170	0.20	0.58	5.4	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
41	22	110	16	280	120	22	2.30	100	140	0.66	1.09	20.0	1
54	22	64	17	420	130	19	1.90	120	110	0.98	0.93	8.1	4
10	20	83	16	530	120	19	1.80	110	100	0.63	0.50	4.4	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
51	20	90	15	350	120	17	1.70	130	100	0.94	0.88	5.7	1
50	20	94	13	390	100	17	1.60	100	100	1.29	0.65	3.0	3
10	20	21	8.5	580	63	13	0.90	57	31	0.87	0.53	3.1	1
61	20	84	18	260	140	20	1.90	120	110	0.81	0.56	6.2	1
49	20	85	18	230	140	21	2.00	110	130	0.78	0.76	14.0	1
49	20	100	18	220	120	22	2.10	110	130	1.06	0.82	6.7	1
13	20	98	17	260	140	16	1.60	100	110	1.46	1.06	19.3	19
15	20	31	10	230	81	23	2.20	57	64	1.19	1.21	13.6	23
10	20	13	3	290	25	10	0.50	25	17	0.70	0.46	9.3	9
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.01	0.36	8.5	1
10	20	17	4.1	120	43	10	0.50	18	29	1.44	1.04	14.5	19
31	20	110	14	190	130	12	1.20	120	110	2.59	1.00	16.0	27
20	20	28	6.7	120	51	9	0.70	51	52	1.21	0.78	16.6	31
16	20	29	6.9	180	47	13	0.90	35	60	0.78	1.26	16.7	12
17	20	20	5.9	70	46	7	0.50	43	49	1.63	7.38	33.5	73
17	20	22	6.8	64	55	8	0.50	45	46	1.05	5.56	34.2	23
10	20	19	4.4	73	32	11	0.50	15	32	0.35	4.14	23.5	6
15	20	23	7.5	71	54	15	0.80	17	43	0.78	8.93	70.3	14
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
13	20	110	13	100	110	12	1.20	150	93	1.58	6.25	84.7	12
26	20	81	10	130	74	11	1.10	100	110	1.50	2.32	34.8	4
10	48	47	6.6	100	53	6	0.60	300	45	1.52	2.13	39.1	5
10	30	22	4.4	160	33	32	2.60	58	29	0.79	2.85	133.6	1
10	190	93	10	95	89	11	1.10	710	66	2.31	10.94	162.9	27
10	38	22	5.1	120	35	41	3.70	40	25	0.72	5.00	33.5	1
10	100	95	13	150	110	8	0.90	220	75	1.60	4.61	52.0	1
10	84	66	11	160	87	11	1.40	180	60	1.25	3.40	39.2	1
12	50	66	13	290	110	10	1.30	150	79	0.96	2.54	35.2	1
41	22	87	14	130	130	11	1.20	120	96	0.71	0.79	18.7	1
19	20	76	14	140	150	14	1.50	140	110	0.48	1.22	17.0	1
19	20	76	14	140	150	14	1.50	140	110	0.48	1.22	17.0	1
18	20	66	13	120	120	15	1.50	140	110	0.41	1.20	17.0	3
43	20	67	12	140	87	19	1.70	60	130	0.36	0.35	8.8	1
46	20	46	13	200	89	24	2.30	76	230	0.22	0.55	6.6	1
83	26	ND	15	170	110	17	1.40	83	100	1.24	1.35	36.6	1
44	28	68	15	180	110	17	1.50	140	130	1.63	1.21	24.5	2
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
44	20	57	12	200	87	17	1.50	86	140	0.27	0.46	13.9	1
58	20	89	16	130	120	21	1.90	100	120	0.27	0.30	11.5	1
54	20	64	12	130	87	23	2.00	53	180	0.49	0.41	10.9	1
27	20	27	10	97	65	30	2.20	40	84	1.77	0.88	15.1	1
24	20	84	16	92	110	18	1.80	64	140	0.69	0.47	7.3	3
26	20	78	16	97	120	18	1.70	97	130	0.94	0.78	9.7	1
11	20	75	14	91	100	18	1.70	73	170	0.80	1.07	12.8	1
45	20	77	15	72	110	16	1.50	84	150	0.67	0.76	11.4	1
10	20	66	12	150	91	17	1.70	60	240	0.29	0.61	7.0	1
23	20	43	14	230	97	17	1.70	69	220	0.56	0.67	8.1	1
43	20	44	13	180	100	16	1.60	68	190	0.47	0.53	7.3	1
44	32	ND	13	180	94	17	1.30	65	86	2.86	1.34	36.2	1
55	20	42	15	180	110	15	1.40	63	160	0.77	0.82	13.0	1
64	20	26	18	140	140	21	1.90	79	130	1.14	0.10	3.2	1
59	20	33	17	120	130	18	1.60	99	110	1.44	0.57	3.2	2
57	ND	35	ND	113	165	23	ND	102	143	ND	ND	ND	ND
63	20	36	17	130	120	19	1.70	120	120	1.49	0.42	4.6	1
19	20	ND	5.4	540	41	57	3.30	34	35	0.10	0.24	2.2	1
36	23	38	13	220	89	17	1.60	170	150	1.31	1.45	39.8	1
59	20	27	16	170	120	19	1.70	98	140	0.55	0.35	5.5	1
14	20	10	5.3	980	39	17	1.10	25	51	0.10	0.30	2.8	1
64	20	20	14	120	120	21	1.70	97	110	1.57	0.85	11.3	1
41	28	44	11	120	70	16	1.50	35	160	2.21	2.09	47.0	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
65	24	18	16	120	120	16	1.40	95	140	1.27	0.71	10.8	1
54	25	45	19	140	150	24	2.10	120	140	2.79	1.24	17.2	3
58	21	15	16	120	130	14	1.30	180	110	1.72	0.66	11.3	1
35	37	10	15	220	110	17	1.60	110	160	1.66	0.80	15.7	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
53	77	15	14	190	94	15	1.40	100	130	4.38	2.65	29.5	2
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
50	20	15	11	170	89	15	1.30	180	160	2.15	0.41	11.0	1
62	20	10	17	170	140	12	1.10	160	120	1.66	0.44	7.8	1
52	ND	2	ND	206	166	18	ND	151	165	ND	ND	ND	ND
41	20	25	13	140	90	19	1.70	280	220	2.74	0.33	7.8	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
61	20	10	19	300	140	19	1.70	110	120	1.13	0.33	3.5	1
49	ND	15	ND	228	180	24	ND	124	164	ND	ND	ND	ND
60	93	10	19	270	140	21	1.90	120	120	ND	ND	ND	ND
58	20	60	15	420	120	19	1.80	110	100	1.31	1.35	7.8	1
45	20	85	15	340	120	20	1.80	100	130	1.01	0.96	5.3	1
35	20	110	15	280	110	24	2.30	81	170	0.26	0.54	4.2	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 1 (continued).

Leg	Hole	Core	Section	Udepth (cm)	Ldepth (cm)	Depth (mbsf)	Ba	Ag	Be	Ce	Co	Cr	Cu	La	Nb
									parts per million						
139	858D	01H	3	112	115	4.12	660	1	1.6	ND	21	76	56	21	10
139	858D	01H	4	80	83	5.30	610	1	1.3	ND	23	77	68	18	10
139	858D	01H	5	84	88	6.84	680	1	1.2	ND	22	100	58	16	10
139	858D	01H	5	106	110	7.06	670	1	1.2	ND	23	99	57	16	12
139	858D	01H	6	25	28	7.75	590	1	1.4	ND	21	75	54	18	10
139	858D	01H	6	30	33	7.80	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858D	02H	1	115	117	10.45	540	1	1.6	ND	19	75	46	19	12
139	858D	02H	1	128	131	10.58	540	1	1.6	ND	17	75	51	19	10
139	858D	02H	2	76	78	11.56	570	1	1.5	ND	21	81	49	18	15
139	858DF	02H	2	95	98	11.75	570	1	1.5	ND	23	83	56	20	15
139	858DF	02H	2	111	113	11.91	ND	ND	ND	ND	ND	ND	ND	ND	ND
139	858DF	02H	3	34	36	12.64	980	1	1.3	ND	21	89	45	17	16
139	858DF	02H	3	133	136	13.63	760	1	1.4	ND	23	90	51	16	14
139	858DF	02H	4	46	48	14.26	600	1	1.3	ND	24	93	52	14	14
139	858DF	02H	4	57	60	14.37	800	1	1.4	ND	25	91	70	19	13
139	858DF	02H	5	36	39	15.66	760	1	1.6	ND	30	91	72	22	16
139	858DF	02H	5	53	55	15.83	1000	1	1.5	ND	30	92	67	19	13
139	858DF	02H	6	36	38	17.16	680	1	1.6	ND	25	80	58	20	17
139	858DF	02H	6	93	96	17.73	660	1	1.4	ND	20	72	54	17	14
139	858DF	02H	7	14	16	18.44	2500	1	1.7	ND	18	94	74	17	10
139	858DF	02H	7	23	25	18.53	954	ND	ND	13	ND	101	63	ND	11
139	858DF	02H	CC	10	12	18.92	1100	1	1.6	ND	20	82	65	19	ND
139	858DF	04H	3	31	35	21.85	380	1	1.6	ND	16	90	42	19	20
139	858DF	04H	3	107	110	22.61	470	1	1.8	ND	25	87	57	20	14
139	858DF	04H	4	59	63	23.63	491	ND	ND	15	ND	114	38	ND	13
139	858DF	04H	4	64	67	23.68	470	1	1.5	ND	20	87	39	24	16
139	858DF	04H	5	35	33	24.87	440	1	1.8	ND	18	74	37	23	19
139	858DF	04H	5	44	48	24.98	460	1	1.9	ND	23	82	36	26	24
139	858DF	04H	6	26	29	26.30	370	1	1.4	ND	21	73	42	15	18
139	858DF	04H	7	36	40	27.90	330	1	1.6	ND	15	76	21	17	20
139	858DF	02R	CC	8	11	27.87	40	1	0.6	ND	10	58	10	11	22
139	858DF	04R	CC	8	10	46.58	60	1	0.5	ND	8	54	10	13	18
139	858DF	08R	CC	11	12	84.81	50	1	0.5	ND	5	55	11	16	20
139	858DF	09R	CC	18	20	94.38	122	ND	ND	109	ND	15	166	ND	9
139	858DF	11R	CC	4	5	114.01	30	1	0.5	ND	6	22	12	10	16
139	858DF	12R	CC	2	3	123.32	120	1	1.0	ND	15	51	10	12	14
139	858DF	13R	CC	6	7	132.96	60	1	0.8	ND	77	48	10	10	ND
139	858DF	13R	CC	7	9	132.97	131	ND	ND	80	ND	66	15	ND	11
139	858DF	14R	1	10	12	142.70	90	1	1.5	ND	14	63	10	31	19
139	858DF	15R	CC	4	6	152.24	80	1	0.5	ND	17	47	75	10	21
139	858DF	17R	CC	16	18	171.76	60	1	0.5	ND	6	43	10	53	16
139	858DF	18R	1	14	16	181.44	40	1	0.9	ND	13	63	10	15	17
139	858DF	21R	1	14	16	210.44	220	1	1.4	ND	26	68	10	14	15
139	858DF	23R	CC	3	5	229.63	50	1	0.7	ND	9	49	49	16	15
139	858DF	25R	1	9	11	248.99	180	1	1.2	ND	19	81	28	15	16
139	858DF	25R	1	19	21	249.09	240	1	1.3	ND	14	86	41	14	16
139	858DF	25R	1	40	42	249.30	229	ND	ND	53	ND	85	19	ND	14
139	858DF	25R	1	61	63	249.51	90	1	1.2	ND	32	80	10	13	17
139	858DF	25R	1	71	73	249.61	130	1	1.3	ND	29	80	10	10	18

Table 1 (continued).

Ni	Pb	Rb	Sc	Sr	V	Y	Yb	Zn	Zr	Se	Sb	As	Mo
parts per million													
48	21	83	17	310	130	23	2.20	94	130	0.45	0.29	6.5	1
52	23	78	16	420	130	18	1.80	110	110	0.78	0.75	7.4	1
68	20	64	16	370	130	18	1.60	97	120	0.49	0.58	2.9	1
76	20	59	16	370	130	18	1.60	100	120	0.47	0.74	3.5	1
55	20	80	16	400	130	18	1.80	100	95	0.40	0.10	2.0	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
55	21	110	14	190	110	17	1.60	88	100	1.49	0.78	3.5	1
58	20	110	14	180	110	18	1.70	100	100	1.10	0.69	2.8	1
61	21	100	16	180	120	17	1.50	120	120	1.18	0.66	3.7	1
62	26	91	17	170	140	20	1.90	120	110	0.97	0.68	2.8	1
ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
52	20	77	19	170	140	18	1.80	98	130	0.34	0.42	4.4	1
65	20	90	18	140	130	17	1.60	100	100	0.62	0.25	4.9	1
65	20	86	19	140	140	15	1.40	100	110	0.72	0.24	3.9	1
68	20	88	18	130	140	21	2.00	110	110	1.05	0.39	4.0	1
72	20	110	18	130	140	20	1.80	120	120	1.62	0.58	8.1	1
67	20	110	19	130	150	19	1.70	110	110	1.90	0.66	12.8	1
41	23	110	18	120	140	20	1.90	90	120	1.22	0.80	8.4	2
42	20	95	16	110	130	19	1.80	110	96	0.90	0.68	5.0	9
10	30	110	15	120	140	17	1.50	130	120	2.85	1.57	40.9	42
60	ND	109	ND	90	180	19	ND	144	130	ND	ND	ND	ND
28	32	ND	17	80	140	20	1.80	1500	110	2.32	3.50	58.6	21
44	20	97	16	85	130	17	1.80	97	160	0.65	1.42	15.4	1
76	20	110	18	77	140	17	1.70	140	120	0.98	1.63	21.2	3
37	ND	108	ND	53	153	19	ND	103	150	ND	ND	ND	ND
61	23	100	14	67	120	16	1.40	110	140	0.90	3.15	18.1	1
51	20	110	16	60	120	16	1.50	140	120	0.41	1.12	10.5	1
62	23	110	15	58	120	16	1.40	150	110	0.44	2.39	18.8	1
61	26	93	15	28	120	21	2.00	180	130	1.05	2.48	28.6	1
46	23	64	14	36	110	20	1.90	28	110	0.99	1.10	19.1	1
39	20	10	10	20	82	10	0.90	44	79	0.23	0.10	0.3	1
27	20	10	8.3	20	64	12	1.20	37	110	0.10	0.10	0.1	1
18	20	10	9.4	66	60	13	1.50	19	150	0.10	0.10	0.1	1
ND	ND	1	ND	54	60	9	ND	12	63	ND	ND	ND	ND
15	20	10	8.2	97	62	8	0.80	13	140	0.10	0.10	0.1	1
28	20	10	17	280	140	15	1.20	85	110	0.10	0.10	0.6	1
65	23	ND	11	91	62	13	0.50	33	61	5.86	0.56	15.1	1
11	ND	ND	ND	196	112	19	ND	39	119	ND	ND	ND	ND
33	20	10	16	240	110	18	1.40	58	160	0.10	0.10	0.7	1
22	20	14	10	42	51	14	1.30	30	130	1.61	0.10	1.6	1
11	20	10	8.4	79	22	11	1.10	11	91	0.10	0.10	0.3	1
32	20	10	13	120	80	13	1.20	42	130	0.78	0.10	0.1	1
56	20	25	19	120	140	17	1.40	82	110	0.30	0.10	3.5	1
22	20	10	11	230	74	16	1.50	21	140	0.30	0.10	4.3	1
46	20	26	20	190	150	19	1.80	80	130	0.84	0.10	5.3	3
42	20	21	21	180	160	18	1.60	94	120	1.83	0.10	2.6	1
41	ND	12	ND	155	205	19	ND	122	103	ND	ND	ND	ND
58	20	10	18	210	120	19	1.60	70	140	1.11	0.91	17.5	1
55	20	11	20	180	150	13	1.30	98	110	0.89	0.50	15.9	1

Notes: Na₂OC = Na₂O - Na₂OX where Na₂OX is sodium precipitated during drying; ND=not determined; Ldepth=lower depth of sample interval in cm; Udepth=upper depth of sample interval in cm; TOC = total organic carbon; Fe₂O₃T= total Fe expressed as Fe₂O₃; H₂OT= water bound in solids, mostly hydrous silicates; element detection limits are: (weight percent) TiO₂ (0.02), MnO (0.01), MgO (0.04), CaO (0.01), Na₂O (0.03), K₂O (0.05), H₂OT (0.1), CO₂ (0.1), S (0.04); (parts per million) Ba (30), Be (0.5), Co (5), Cr (10), Cu (10), La (10), Nb (10), Ni (10), Pb (10), Rb (10), Sc (0.5), Sr (20), V (5), Y (5), Yb (0.5), Zn (5), and Zr (10). Values less than the detection limit are expressed as one-half the detection limit.