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1. Data Report: Low-Grade Hydrothermal Alteration of Uplifted Lower Oceanic Crust, Hole 735B: Mineralogy and Isotope Geochemistry[1]

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ABSTRACT

The mineralogy and stable (O and C) and Sr isotopic compositions of low-temperature alteration phases were determined in Hole 735B gabbroic rocks in order to understand the processes of low-temperature alteration in this uplifted block of lower oceanic crust. Phyllosilicates include smectite (saponite, Mg montmorillonite, and nontronite), chlorite/smectite, chlorite, talc, and serpentine. Other phases include prehnite, albite, K-feldspar, analcite, natrolite, thompsonite, pyrite, and titanite. The low-grade mineral assemblages mainly represent zeolite facies and lower-temperature "seafloor weathering" processes. Phyllosilicates formed over a range of temperatures but may also reflect variable reaction progress. Alteration temperatures were probably somewhat greater below 1300 meters below seafloor. Mineralogy and isotopic data indicate that conditions were mostly reducing and that seawater solutions were rock dominated. Carbonates formed late from cold and generally oxidizing seawater solution, however, as seawater penetrated downward as the result of fracturing and faulting in the uppermost portion of the uplifted crustal block.

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INTRODUCTION

Hole 735B is located on an uplifted block of 11.5-Ma lower oceanic crust east of the Atlantis II Fracture Zone on the Southwest Indian Ridge. During Ocean Drilling Program Leg 118, 504 m of gabbroic rock was penetrated at this site, and the hole was extended 1004 m deeper during Leg 176, reaching a total penetration of 1508 m into lower crustal rock (Dick et al., 1991; Shipboard Scientific Party, 1999). The upper 0.3–0.5 km of the core exhibits abundant effects of high-temperature axial hydrothermal alteration (Dick et al., 1991; Stakes et al., 1991; Vanko and Stakes, 1991), but in the deeper 1 km penetrated during Leg 176, these hydrothermal effects are significantly diminished and are essentially restricted to minor amphibole veins and microveinlets (Shipboard Scientific Party, 1999). Zones of lower-temperature alteration are common locally, as documented by the presence of carbonate and smectite in veins and rocks. As part of a general study of the mineralogy and chemistry of alteration of the drill core, we undertook a study focusing on these lower-temperature hydrothermal effects. This report documents the secondary mineralogy of lower-temperature phases and presents stable and strontium isotopic data for vein minerals in order to understand the conditions of late fluid penetration and alteration. Complementary data on the chemical effects of this alteration on the crust are presented elsewhere (Bach et al., 2001).

METHODS

Secondary minerals were identified optically in thin section and by examination using backscattered electron imaging in scanning electron microscope and electron microprobe, coupled with compositional spectra from energy-dispersive X-ray analyses. Quantitative chemical analyses were performed with an automated Cameca CAMEBAX MBX microbeam with four wavelength-dispersive spectrometers and a JEOL JX-733 superprobe, both using a 10-nA beam current and 15-kV accelerating potential. Natural and synthetic mineral standards were used for calibration.

Secondary phyllosilicates and carbonates were scraped from veins for confirmation of mineralogy by X-ray diffraction analysis. Smear slides and oriented mounts were scanned at 2°2θ/min with CuK_α radiation in an automated Scintag diffractometer. Oriented mounts of phyllosilicates were analyzed after air drying and after saturation with ethylene glycol.

Oxygen was extracted from whole-rock powders and from secondary minerals by reaction with ClF_3 and converted to CO_2 gas for measurement of oxygen isotope ratios at the University of Michigan (Clayton and Mayeda, 1963). Phyllosilicates were dried at 110°C, stored overnight with P_2O_5, and degassed under vacuum at 150°–175°C for 6 hr prior to fluorination. Repeated extractions and measurements of samples and standards were reproducible within ±0.2‰. CO_2 from carbonates was liberated by dissolution in phosphoric acid, and carbon and oxygen isotope ratios were measured at the University of Michigan.

Sr isotope analyses and Sr concentration measurements were carried out at Woods Hole Oceanographic Institution (WHOI) using a VG 54 thermal ionization mass spectrometer. Samples were spiked with ^{84}Sr and dissolved in 2.5-N HCl (carbonates) and $HF/HClO_4$ (clays) in a

Teflon beaker. Sr was separated in quartz columns with a 5-mL resin bed of AG50W-X12 200–400 mesh. $^{87}Sr/^{86}Sr$ are reported relative to National Bureau of Standards (NBS) 987 = 0.71024. Within-run precisions are reported in Table T1; external precision (2 σ) of Sr isotope analyses at WHOI is usually 0.003%.

T1. Isotopic data for vein minerals, p. 14.

RESULTS

Summary of Leg 176 Metamorphic Petrology

Rocks

Gabbroic rocks from Hole 735B record high-temperature metamorphism that began at near solidus temperatures, as well as hydrothermal alteration that continued down to zeolite facies and lower-grade metamorphic conditions (Stakes et al., 1991; Vanko and Stakes, 1991; Shipboard Scientific Party, 1999). The uppermost 300 m of the Leg 118 section of Hole 735B is intensely altered at high temperatures, leading to its interpretation as the roots of an axial hydrothermal cell (Vanko and Stakes, 1991; Mével and Cannat, 1991; Dick et al., 1991; Alt, 1995). The veining and metamorphism observed deeper in the section reflect penetration of fluids into the lower crust in a waning axial cell and as the crust moved off-axis, as well as during later fracturing and uplift of the crustal block. The following petrographic summary is modified from the Shipboard Scientific Party (1999) based on our subsequent postcruise work.

The rocks from Hole 735B (Leg 176) are generally slightly altered (0%–20%), but are locally more intensely recrystallized as the result of high-temperature plastic deformation. Below 1000 meters below seafloor (mbsf) there are large intervals where the rocks are <10% recrystallized. In undeformed rocks, "static" alteration is related to fracturing at various scales and penetration of aqueous fluids into the rocks. Olivine alteration varies from cracks filled with talc and serpentine + magnetite in the least-altered grains to coronitic alteration and total replacement by talc + serpentine + colorless Mg amphibole + magnetite. Orthopyroxene is present in more evolved rocks and as local rims on olivine grains and is variably altered to colorless or green amphibole, minor smectite, chlorite/smectite, talc, and magnetite. Clinopyroxene is variably replaced by brown and green amphiboles and local trace chlorite and serpentine. Brown amphibole is present chiefly in sheared oxide gabbros, but also is present elsewhere, generally making up <1% percent of the rock, whereas green amphibole may locally comprise up to 50% of the rock. Plagioclase is the most stable phase, and over large intervals alteration is 1% or less to actinolite, chlorite/smectite, or smectite along cracks, although minor epidote, prehnite, and chlorite are also present associated with veins. The intensity of macroscopic alteration is related to visible veins (see below), but at a smaller scale, crystals are more altered along tiny veinlets (<200 µm) of amphibole, plagioclase, chlorite, and local epidote and prehnite.

Veins

Veins comprise nearly 1% of the Leg 176 core by volume, generally decreasing in abundance with depth. Higher-temperature veins include felsic veins, plagioclase veins, plagioclase + amphibole veins, clinopyroxene-bearing veins, and amphibole veins (Shipboard Scientific Party, 1999) (Fig. F1). Lower-grade veins are described below.

Carbonate veins in the Leg 176 section average 0.5 mm wide and are concentrated in the 500- to 600-mbsf interval (Fig. F1), where the rocks are altered to orange phyllosilicates, iron oxyhydroxide, and calcite. Fracturing related to a major cataclastic fault at 560 mbsf probably provided pathways for seawater solutions into this zone. Another cataclastic fault at 490 mbsf may also have contributed to fracturing. Although macroscopic carbonate veins are restricted to depths less <600 m, microscopic carbonate veins and elevated bulk rock CO_2 contents are present below this depth (Bach et al., 2001).

Smectite and chlorite/smectite veins were originally all described as smectite on board ship and are the most abundant veins by number. They are 0.1–7 mm wide and have generally moderate dips (mostly 20°–40°). These veins are concentrated in two zones: 575–835 and 1050–1500 mbsf (Fig. F1). Fracturing related to the fault at 560 mbsf and another major cataclastic fault at 690–700 mbsf may have provided pathways for seawater solutions to form smectite and chlorite/smectite in and along fractures. Phyllosilicate veins below 1050 mbsf are present in tensional fractures unrelated to faults. Throughout the core, olivine, plagioclase, and pyroxene that are in the host rocks for up to 1–2 cm along the smectite and chlorite/smectite veins are variably altered to smectite, chlorite/smectite, ± magnetite, pyrite, and pyrrhotite.

Zeolite and prehnite veins are present at 1300–1490 mbsf within the smectite-chlorite/smectite–rich zone near the base of the core (Fig. F1). These veins are mostly ~1 mm wide and contain natrolite, analcite, thompsonite, and prehnite. Also associated are smectite, chlorite/smectite, albite, and K-feldspar. All these minerals are present both in veins and in the adjacent altered host rock.

Preliminary shipboard identification of rare local chlorite veins (Fig. F1) are shown by our subsequent work to be in error; these vary from chlorite to chlorite/smectite. Alteration halos in the host rocks contain chlorite/smectite, albite, prehnite, natrolite, analcite, thompsonite, and K-feldspar. Other veins include six quartz veins, two of amorphous silica, and a single large (12 mm) epidote vein.

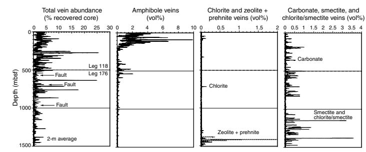
Phyllosilicate Mineralogy

In shipboard descriptions and the core log, phyllosilicates were logged as chlorite or smectite (Shipboard Scientific Party, 1999). In contrast, our results show that the mineralogy of phyllosilicates in Hole 735B is highly variable, commonly on the scale of a single thin section and even within individual veins. For example, Sample 176-735B-172R-7, 132 cm, contains a zoned vein that ranges continuously from chlorite at the margins to smectite-rich chlorite/smectite at the center (Fig. F2; Table T2). Other phyllosilicates present include various smectites, talc, serpentine, and phlogopite, as well as fine-scale intergrowths, mixtures, and partial replacement relations among these phases, all reflecting varying conditions of hydrothermal alteration.

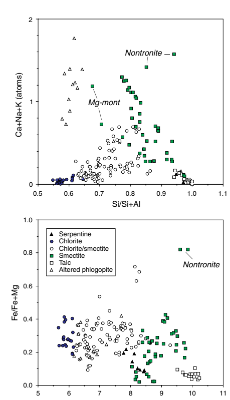
Chlorite in the gabbroic rocks is relatively Mg rich, having Fe/Fe+Mg = 0.25–0.4 compared to values of 0.3–0.6 for chlorites in oceanic metabasalts and diabases (see review in Alt, 1999) (Fig. F2). Compared to chlorite, mixed-layer chlorite/smectite falls along a broad trend of increasing Si and interlayer cation contents and is locally Fe rich (Fig. F2).

Smectites in Hole 735B are predominantly Fe-bearing saponites, having compositions that are somewhat variable but generally similar to

F1. Vein abundances in Hole 735B, p. 9.



F2. Composition of phyllosilicates, p. 10.



T2. Electron microprobe analyses of phyllosilicates, p. 15.

that of saponite in altered seafloor basalts (see review in Alt, 1999). Saponites have variable ratios of Fe/Fe+Mg and covarying contents of Si, Al, and interlayer cations and range from near talc through low-charge to higher-charge smectite (Fig. F2). Interlayer cations are dominated by Ca + Na (Fig. F3). Small amounts of chlorite interlayers are present in many samples, as indicated by high octahedral totals (Schiffman and Fridleifsson, 1991). Talc and serpentine may be present in some analyses as well, as suggested by locally very low interlayer cation and Fe contents (Fig. F2).

Talc is locally present, commonly with small amounts of chlorite and smectite layering, as shown by high Al, Fe, and interlayer cation contents (Table T2; Fig. F2). A serpentine phase is also present locally and has high Mg content (up to 36 wt% MgO) (Table T2). Elevated Al, Fe, and interlayer contents, however, suggest the presence of chlorite and smectite layers.

Nontronite was identified in one sample at 592.8 mbsf (Sample 176-735B-102R-3, 1 cm). Compared to saponite, it is Fe and K rich. The octahedral cation occupancy is high for nontronite (Fig. F4) and may be related to the presence of trioctahedral saponite layers. Relatively high interlayer cation contents (Fig. F4) suggest the presence of celadonite (mica) as well.

Mg montmorillonite was identified in a vein at 1241.7 mbsf (Sample 176-735B-181R-2, 7 cm) and is distinguished from saponite by high Al content (19 wt% Al_2O_3) and low octahedral site occupancy (Fig. F4). Some saponite analyses trend slightly to higher Al and lower octahedral occupancy, indicating the presence of a montmorillonite component.

Biotite/phlogopite is present in felsic veins and in reaction coronas around olivine. Many analyses of olivine and clinopyroxene alteration products fall along a trend from phlogopite to chlorite or chlorite/smectite (Fig. F2). This may reflect fine intergrowths of phlogopite and chlorite or loss of K and Na from interlayer positions during hydrothermal alteration of early-formed phlogopite.

There are some changes in phyllosilicate mineralogy below ~1300 mbsf (Fig. F5). Below this depth, smectite, talc, and serpentine have not been identified. The presence of chlorite and chlorite/smectite and the absence of smectite below 1300 mbsf suggest that alteration occurred at higher temperatures here than shallower in the core. Two samples from deep in the hole (>1475 mbsf) also exhibit relatively high abundances of greenschist-facies minerals (albite, chlorite, and amphibole), also consistent with more abundant higher-temperature (>250°) alteration (but still low grade) at depth.

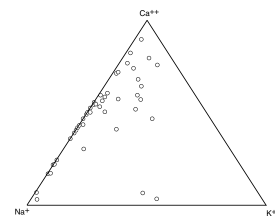
Other Minerals

Other minerals include prehnite, albite, K-feldspar, analcite, natrolite, and thompsonite, which partly replace plagioclase and fill small veins associated with chlorite/smectites. Representative electron microprobe analyses of these phases are given in Table T3. Pyrite and titanite are also commonly associated in pseudomorphs after olivine and replacing titanomagnetite, respectively. Prehnite and zeolites are most abundant below ~1300 mbsf where smectite is absent (Figs. F1, F5).

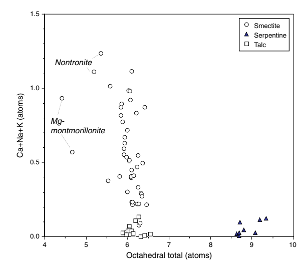
Isotopic Data

Phyllosilicates separated from veins have $\delta^{18}O$ values of 7.1‰ to 19.9‰ (Table T1), which indicate formation from seawater at tempera-

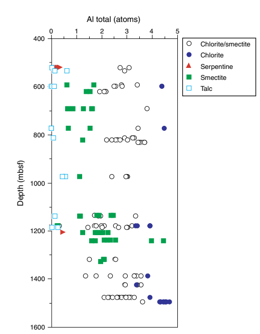
F3. Interlayer cation contents of smectites, p. 11.



F4. Octahedral cation total vs. interlayer cations, p. 12.



F5. Total formula Al content of phyllosilicates vs. depth, p. 13.



T3. Electron microprobe analyses of secondary minerals, p. 23.

tures of ~60°–110°C (Savin and Lee, 1988). Application of temperature-dependent mineral-water isotopic fractionation factors in the remaining cases is problematic because of the mixtures of minerals that are present. Using the chlorite-water oxygen isotopic fractionation from Wenner and Taylor (1971) gives temperatures of <100°C for four chlorite-rich samples. More realistic temperatures of 150°–300°C for chlorite-rich mixtures implies formation from evolved, ^{18}O-enriched fluids. The high Sr content (105 ppm) of one chlorite/smectite sample suggests the presence of small amounts of a contaminant (e.g., prehnite), which could in part explain the high $\delta^{18}O$ value of this sample (Table **T1**).

Strontium isotopic data for phyllosilicate veins indicate highly rock-dominated fluids, with six $^{87}Sr/^{86}Sr$ ratios of 0.70312–0.70338 and two higher values ranging up to 0.70492 (Table **T1**).

Carbonates have uniform $\delta^{18}O$ values of 31.2‰–32.5‰ (Table **T1**), which translate into formation temperatures of ~10°C if formed from normal seawater (O'Neil et al., 1969). $^{87}Sr/^{86}Sr$ ratios are mostly 0.70865–0.70891, similar to 0- to 10-Ma seawater (0.7091–0.7088) (Hodell et al., 1991), but two lower values suggest more rock-dominated fluids (Table **T1**). Sr contents of carbonates are also roughly consistent with formation from seawater (150–280 ppm for calcite and 3200 ppm for aragonite). However, one calcite having low $^{87}Sr/^{86}Sr$ also has a very low Sr content (23 ppm). Carbonate $\delta^{13}C$ values of ~0‰ to +3‰ are consistent with formation from seawater, with one lower value of –2.7‰ suggesting more evolved fluids (Table **T1**). The low $^{87}Sr/^{86}Sr$ values of carbonates correspond with low $\delta^{13}C$ and $\delta^{18}O$, which is consistent with more evolved fluids.

SUMMARY

The phyllosilicates in Hole 735B range from smectite to chlorite/smectite to chlorite and record varying temperatures and fluid compositions. The low-grade mineral assemblages mainly represent subgreenschist conditions (i.e., zeolite facies and lower-temperature "seafloor weathering") (see review in Alt, 1999).

Conditions were generally reducing, as shown by the presence of pyrite and the trioctahedral phyllosilicates, which contain all Fe as the ferrous ion. Sr and O isotopes indicate generally rock-dominated solution compositions.

Phyllosilicates formed over a range of temperatures but may also reflect variable reaction progress (i.e., variable extent of fluid-rock reaction and release of Al to be incorporated into chlorite or chlorite/smectite) (see discussion in Alt, 1999). Talc and serpentine are stable over a wide range of temperatures but reflect low water/rock ratios and limited reaction of the rock. The lack of smectite below 1300 mbsf suggests alteration at slightly higher temperatures below this depth.

Carbonates formed late from cold seawater solutions. More oxidizing conditions are indicated by the association of iron oxides with carbonates and phyllosilicates in the upper 600 m of the hole and by the local presence of nontronite in this zone. Saponite having low Fe/Fe+Mg ratios could also be related to more oxidizing conditions (Andrews, 1980; see review in Alt, 1999). Macroscopic carbonate veins are restricted to the upper 600 m of the core, which suggests penetration of seawater generally downward related to fracturing and faulting in the uppermost portion of the uplifted crustal block.

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REFERENCES

Alt, J.C., 1995. Subseafloor processes in mid-ocean ridge hydrothermal systems. *In* Humphris, S.E., Zierenberg, R., Mullineaux, L., and Thomson, R. (Eds.), *Seafloor Hydrothermal Systems: Physical, Chemical, Biological and Geological Interactions within Hydrothermal Systems*. Am. Geophys. Union Monogr., 91:85–114.

Alt, J.C., 1999. Very low grade hydrothermal metamorphism of basic igneous rocks. *In* Frey, M., and Robinson, D. (Eds.), *Very Low Grade Metamorphism:* Cambridge (Blackwell), 169–201.

Andrews, A.J., 1980. Saponite and celadonite in Layer 2 basalts, DSDP Leg 37. *Contrib. Mineral. Petrol.,* 73:323–340.

Bach, W., Alt, J.C., Niu, Y., Humphris, S.E., Erzinger, J., and Dick, H.J.B., 2001. The geochemical consequences of late-stage low-grade alteration of lower ocean crust at the SW Indian Ridge: results from ODP Hole 735B (Leg 176). *Geochim. Cosmochim. Acta,* 65:3267–3287.

Clayton, R.N., and Mayeda, T.K., 1963. The use of bromine pentafluoride in the extraction of oxygen from oxides and silicates for isotopic analysis. *Geochim. Cosmochim. Acta,* 27:43–52.

Dick, H.J.B., Meyer, P.S., Bloomer, S., Kirby, S., Stakes, D., and Mawer, C., 1991. Lithostratigraphic evolution of an in-situ section of oceanic Layer 3. *In* Von Herzen, R.P., Robinson, P.T., et al., *Proc. ODP, Sci. Results,* 118: College Station, TX (Ocean Drilling Program), 439–538.

Hodell, D.A., Mueller, P.A., and Garrido, J.R., 1991. Variations in the strontium isotopic composition of seawater during the Neogene. *Geology,* 19:24–27.

Mével, C., and Cannat, M., 1991. Lithospheric stretching and hydrothermal processes in oceanic gabbros from slow-spreading ridges. *In* Peters, T., Nicolas, A., and Coleman, R.J. (Eds.), *Ophiolite Genesis and Evolution of the Oceanic Lithosphere.* Petrol. Struct. Geol., 5:293–312.

O'Neil, J.R., Clayton, R.N., and Mayeda, T.K., 1969. Oxygen isotope fractionation in divalent metal carbonates. *J. Chem. Phys.,* 51:5547–5558.

Savin, S.M., and Lee, M., 1988. Isotopic studies of phyllosilicates. *In* Bailey, S.W. (Ed.), *Hydrous Phyllosilicates (Exclusive of Micas):* Min. Soc. Am., Rev. Mineral., 19:189–223.

Schiffman, P., and Fridleifsson, G.O., 1991. The smectite-chlorite transition in drillhole Nj-15, Nesjavellir geothermal field, Iceland: XRD, BSE and electron microprobe investigation. *J. Metamorph. Geol.,* 9:679–696.

Shipboard Scientific Party, 1999. Site 735. *In* Dick, H.J.B., Natland, J.H., Miller, D.J., et al., *Proc. ODP, Init. Repts.,*176, 1–314 [CD-ROM]. Available from: Ocean Drilling Program, Texas A&M University, College Station, TX 77845-9547, U.S.A.

Stakes, D., Mével, C., Cannat, M., and Chaput, T., 1991. Metamorphic stratigraphy of Hole 735B. *In* Von Herzen, R.P., Robinson, P.T., et al., *Proc. ODP, Sci. Results,* 118: College Station, TX (Ocean Drilling Program), 153–180.

Vanko, D.A., and Stakes, D.S., 1991. Fluids in oceanic layer 3: evidence from veined rocks, Hole 735B, Southwest Indian Ridge. *In* Von Herzen, R.P., Robinson, P.T., et al., *Proc. ODP, Sci. Results,* 118: College Station, TX (Ocean Drilling Program), 181–215.

Wenner, D.B., and Taylor, H.P., Jr., 1971. Temperatures of serpentinization of ultramafic rocks based on $^{16}O/^{18}O$ fractionation between coexisting serpentine and magnetite. *Contrib. Mineral. Petrol.,* 32:165–185.

Figure F1. Vein abundances in Hole 735B as volume percent of recovered core (2-m averages). Chlorite and smectite veins were logged on board ship, but postcruise results show that both consist of variable amounts of chlorite, chlorite/smectite, and smectite. Zeolites include natrolite, thompsonite, and analcite (after Shipboard Scientific Party, 1999).

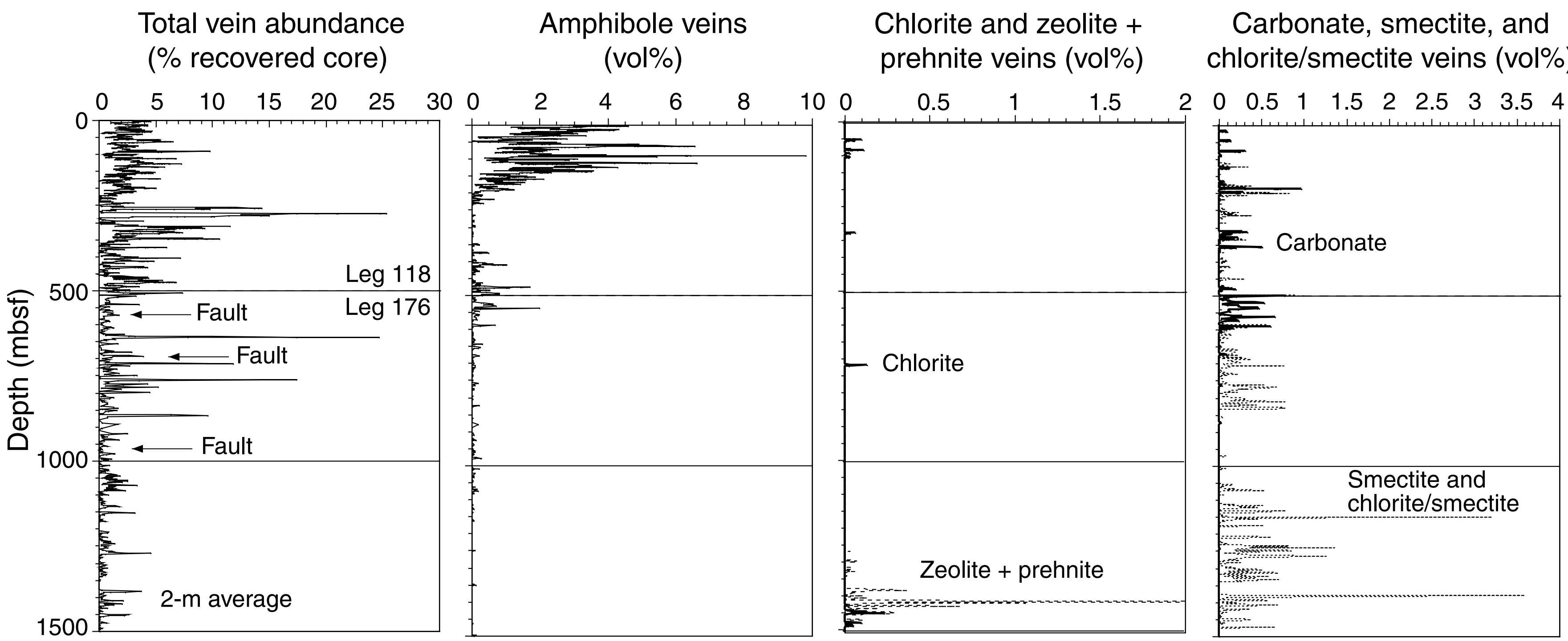

Figure F2. Composition of phyllosilicates in Leg 176 rocks calculated as chlorite formulas (total layer charge = 56; all Fe as Fe^{2+}). Smectites are saponite except where noted. See "Phyllosilicate Mineralogy," p. 4, in "Results" for discussion.

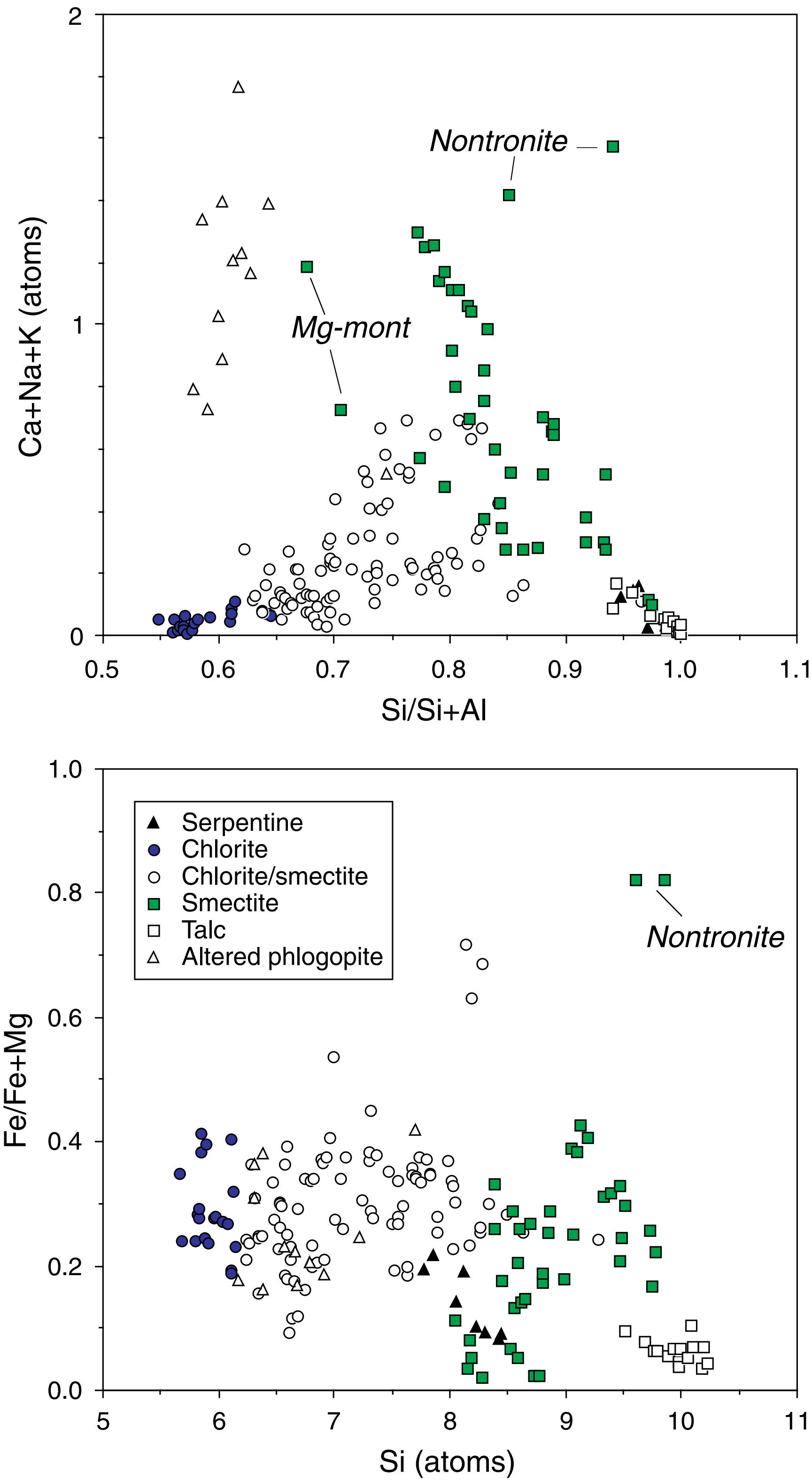

Figure F3. Interlayer cation contents of smectites. Formulas calculated as smectites (total layer charge = 44; all Fe as Fe^{2+}). Two nontronite analyses have high K content (center bottom of plot).

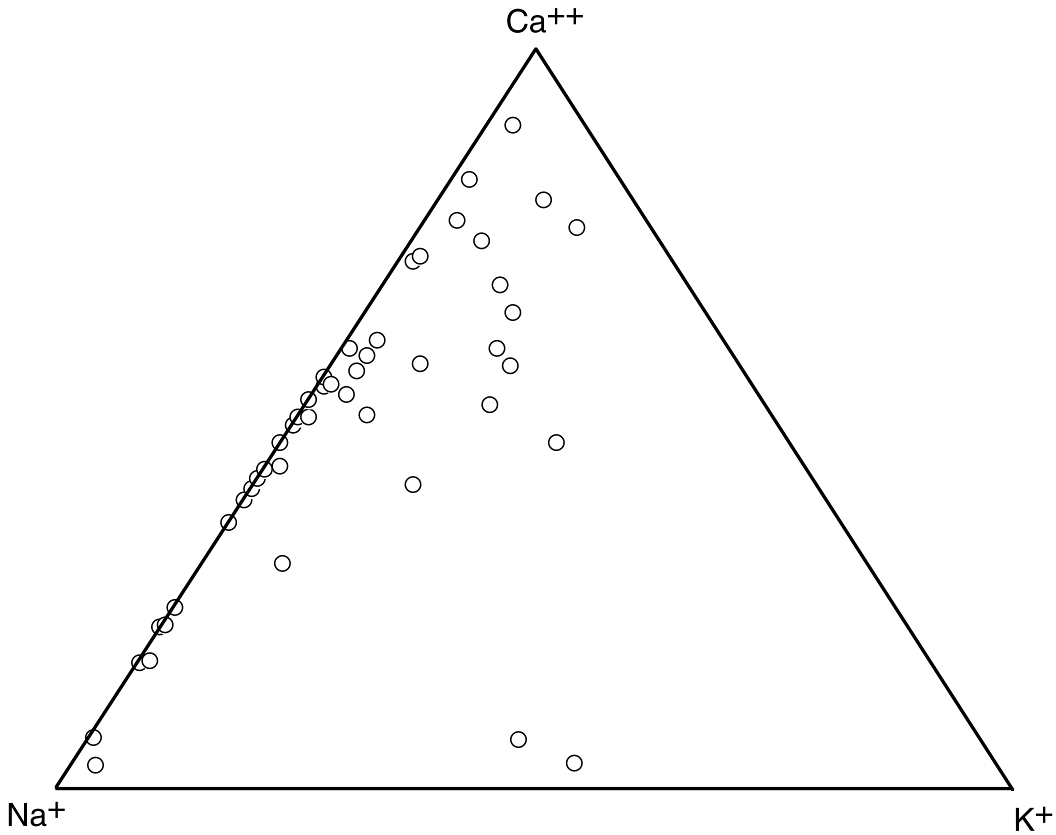

Figure F4. Octahedral cation total vs. interlayer cations for smectites, talc, and serpentine. Formulas calculated as smectites (total layer charge = 44; all Fe as Fe^{2+}). Smectites are saponite except where noted. See "Phyllosilicate Mineralogy," p. 4, in "Results" for discussion.

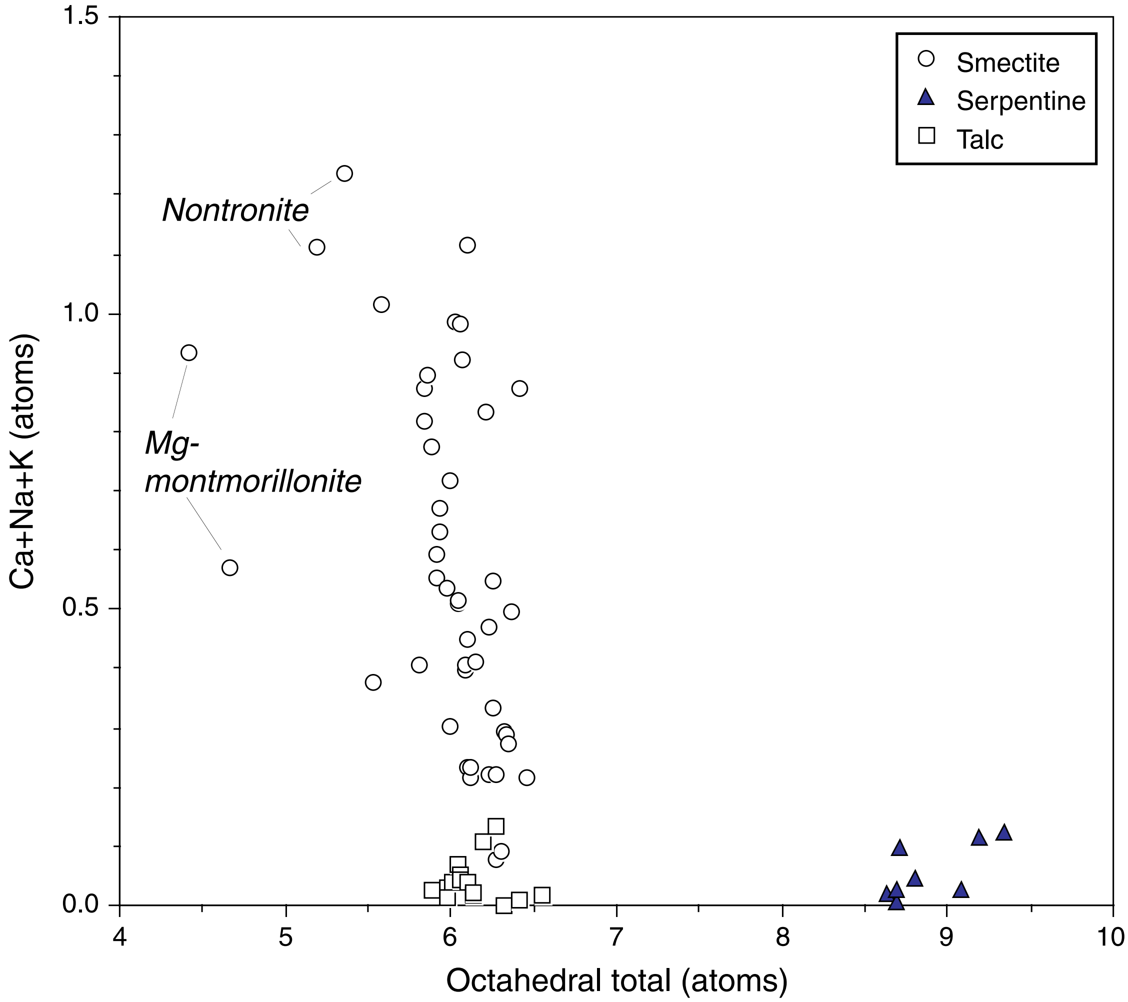

Figure F5. Total formula Al content of phyllosilicates vs. depth. Formulas calculated as chlorites (total layer charge = 56; all Fe as Fe^{2+}). Smectites include saponite, nontronite, and Mg montmorillonite. Note the absence of smectite below ~1300 mbsf (see **"Phyllosilicate Mineralogy,"** p. 4, in "Results" for discussion).

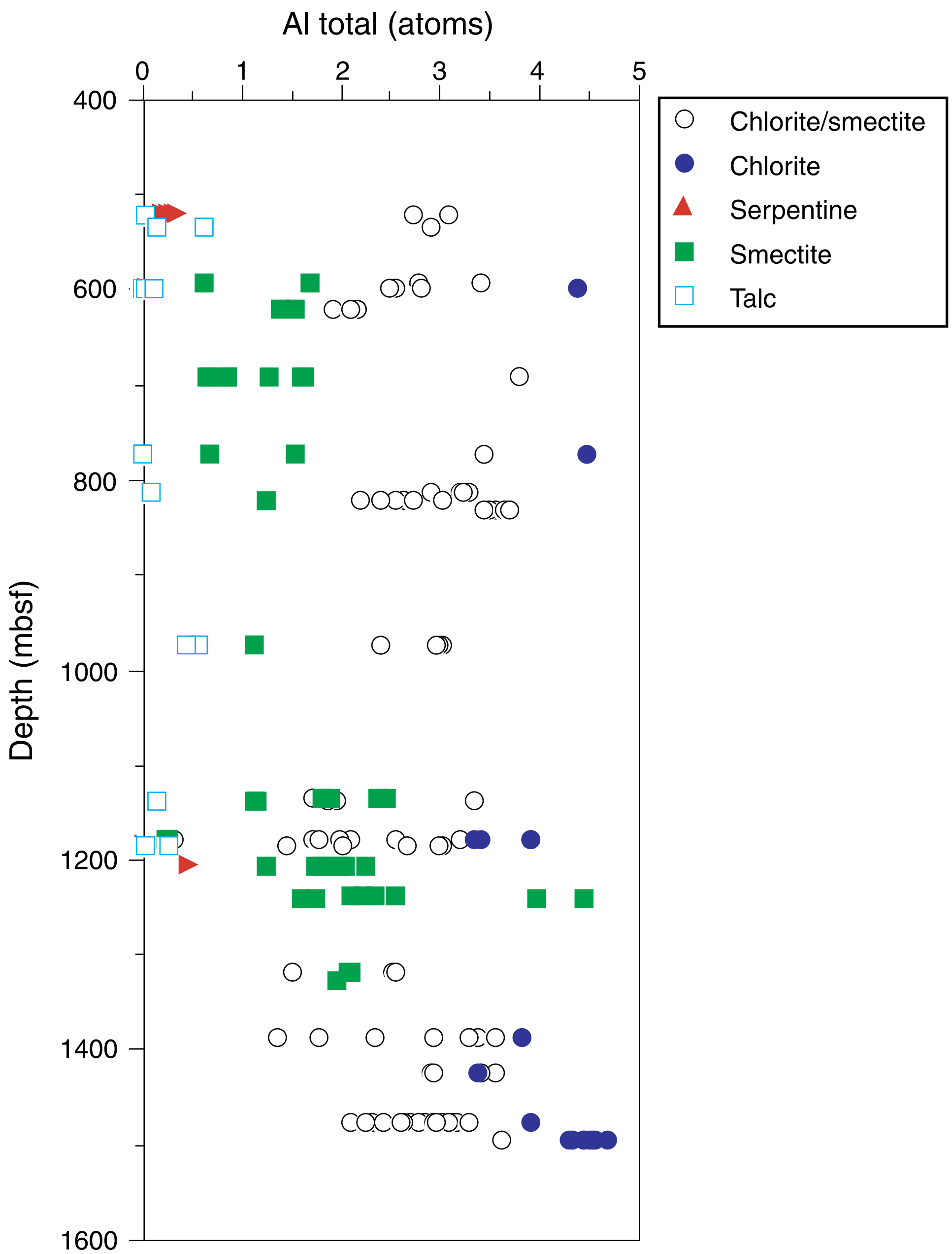

Table T1. Isotopic data for vein minerals.

Core, section, interval (cm)	Piece	Depth (mbsf)	Mineralogy	$\delta^{18}O$ (SMOW)	$\delta^{13}C$ (PDB)	$^{87}Sr/^{86}Sr$	2 σ	Sr (ppm)	2 σ	Rb (ppm)	2 σ	$^{87}Sr/^{86}Sr$*
176-735B-												
107R-1, 81–86	3B	620.31	Chlorite/smectite	19.9		0.704921	8	32.23	0.01	1.22	0.32	0.704904
118R-1, 8–14	4	690.88	Smectite	18.3		0.703341	9	42.09	0.03	0.95	0.22	0.703331
133R-7, 107–111	1F	832.33	Chlorite (+ smectite)	11.1		0.703610	9	30.24	0.02	0.48	0.18	0.703603
172R-7, 132–137	4B	1178.13	Chlorite + c/s	9.7		0.705427	8	18.65	0.01	0.73	0.20	0.705409
181R-2, 7–13	1B	1241.70	Mg montmorillonite	13.2		0.703376	9	27.69	0.02	0.61	0.19	0.703366
197R-2, 34–40	5B	1385.14	Chlorite + c/s	11.7		0.703120	8	46.82	0.02	1.12	0.34	0.703109
202R-2, 135–141	6B	1423.94	Chlorite (+ c/s)	7.1		0.703142	9	48.68	0.03	1.34	0.27	0.703129
207R-5, 53–57	5	1474.90	Chlorite/smectite	11.6		0.703226	8	105	0.2	0.26	0.06	0.703225
90R-8, 8–104		517.07	Aragonite?	32.6	3.2	0.708882	7	3204	70			
93R-1, 1–86		532.81	Calcite	32.4	3.1	0.708913	9	260.4	0.2			
96R-1, 1–36		549.13	Calcite	31.1	0.3	0.708652	9	149.7	0.1			
99R-1, 1–113		567.24	Calcite	31.9	2.7	0.708708	7	249.2	0.1			
102R-3, 3–1		593.39	Calcite	31.4	2.8	0.708889	9	282.2	0.1			
103R-4, 4–72		602.11	Calcite	31.2	–0.4	0.705495	9	23.25	0.01			
107R-1, 81–86		620.31	Calcite	32.0	2.7							
116R-3, 3–39		674.85	Calcite	31.2	–2.7	0.706881	10					

Notes: * = age corrected, assuming T = 11.5 Ma. c/s = chlorite/smectite. Minor mineral phases are in parentheses. SMOW = standard mean ocean water, PDB = Peedee belemnite.

Table T2. Representative electron microprobe analyses of phyllosilicates. (See table notes. Continued on next seven pages.)

															Formula (28 Ox)		Formula (22 Ox)				
Core, section, interval (cm)	Depth (mbsf)	Mineral	Occurrence	SiO_2	Al_2O_3	TiO_2	Cr_2O_3	MgO	FeO	MnO	CaO	Na_2O	K_2O	Total	Si	Al total	Si	Al tet	Al total	Ti	Cr
176-735B-																					
91R-3, 100	520.98	c/s	o	34.20	11.95	0.00	0.00	32.34	7.47	0.03	0.17	0.04	0.00	86.20	6.64	2.73				0.00	0.00
91R-3, 100	520.98	c/s	o	34.91	13.60	0.02	0.00	31.02	7.30	0.02	0.07	0.06	0.00	87.00	6.68	3.06				0.00	0.00
93R-1, 86	532.99	c/s	o	34.77	13.00	0.00	0.00	33.36	5.95	0.02	0.06	0.00	0.06	87.22	6.61	2.91				0.00	0.00
102R-3, 1	592.83	c/s	v	35.24	14.70	0.00	0.00	24.06	11.46	0.18	0.27	0.20	0.13	86.24	6.92	3.40				0.00	0.00
102R-3, 1	592.83	c/s	v	36.38	11.71	0.00	0.00	18.26	20.28	0.08	0.60	0.82	0.33	88.46	7.31	2.77				0.00	0.00
103R-2, 139	597.60	Chlorite	v	28.10	17.86	0.03	0.01	19.17	21.22	0.32	0.01	0.00	0.01	86.73	5.85	4.38				0.00	0.00
103R-2, 139	597.60	Chlorite	c	28.23	17.98	0.05	0.03	18.30	22.83	0.28	0.16	0.06	0.02	87.94	5.85	4.39				0.01	0.00
103R-4, 18	599.35	c/s	v	34.59	11.69	0.00	0.00	20.60	18.83	0.29	0.25	0.39	0.02	86.66	7.06	2.81				0.00	0.00
103R-4, 18	599.35	c/s	v	38.30	10.51	0.00	0.00	17.57	16.70	0.15	0.40	1.11	0.06	84.80	7.83	2.53				0.00	0.00
103R-4, 18	599.35	c/s	v	39.18	10.29	0.00	0.00	16.56	17.34	0.17	0.28	1.10	0.07	84.99	7.99	2.47				0.00	0.00
107-1, 8	620.31	c/s	v	37.34	9.14	0.00		21.03	20.35	0.17	0.54	0.06	0.04	88.68	7.47	2.15				0.00	
107-1, 8	620.31	c/s	v	37.46	8.67	0.03		19.84	18.73	0.26	0.80	0.06	0.08	85.92	7.68	2.09				0.00	
107-1, 8	620.31	c/s	v	36.26	8.69	0.00		18.94	17.76	0.16	0.66	0.07	0.07	82.61	7.70	2.17				0.00	
107-1, 8	620.31	c/s	v	37.09	8.47	0.00		18.62	17.59	0.20	0.71	0.07	0.07	82.82	7.83	2.11				0.00	
107-1, 8	620.31	c/s	v	35.49	7.27	0.00		17.42	15.87	0.17	0.77	0.07	0.06	77.13	8.01	1.93				0.00	
118-1, 8	690.88	Chlorite	o	29.90	15.46	0.04		24.55	11.67	0.13	0.14	0.03	0.86	82.80	6.23	3.80				0.01	
127R-5, 12	770.69	c/s	v	31.75	14.28	0.00	0.00	21.55	19.28	0.28	0.16	0.05	0.00	87.35	6.47	3.43				0.00	0.00
127R-5, 12	770.69	Chlorite	v	28.63	18.36	0.00	0.00	18.53	21.65	0.35	0.06	0.04	0.00	87.62	5.90	4.46				0.00	0.00
132R-1, 70	813.94	c/s	o	33.55	13.49	0.00	0.00	20.70	18.80	0.26	0.33	0.13	0.01	87.27	6.80	3.22				0.00	0.00
132R-1, 70	813.94	c/s	v	33.31	13.77	0.00	0.00	20.52	18.96	0.30	0.32	0.13	0.00	87.31	6.75	3.29				0.00	0.00
132R-1, 70	813.94	c/s	o	33.76	13.35	0.00	0.00	20.61	18.93	0.26	0.34	0.13	0.00	87.38	6.83	3.18				0.00	0.00
132R-1, 70	813.94	c/s	v	34.63	11.63	0.00	0.00	15.27	22.31	0.19	0.73	0.33	0.05	85.14	7.32	2.89				0.00	0.00
132R-8, 103	823.23	c/s	o	31.83	12.38	0.00	0.00	20.00	22.96	0.19	0.18	0.12	0.01	87.67	6.60	3.02				0.00	0.00
132R-8, 103	823.23	c/s	v	34.78	10.85	0.00	0.00	17.62	18.98	0.23	0.51	0.51	0.01	83.49	7.37	2.71				0.00	0.00
132R-8, 103	823.23	c/s	o	37.29	11.01	0.00	0.00	18.99	17.32	0.21	0.59	0.66	0.08	86.15	7.55	2.63				0.00	0.00
132R-8, 103	823.23	c/s	c	38.38	10.85	0.02	0.00	18.43	18.28	0.28	0.79	0.32	0.07	87.42	7.67	2.55				0.00	0.00
132R-8, 103	823.23	c/s	o	38.39	10.05	0.00	0.00	18.90	16.80	0.13	0.72	0.90	0.09	85.98	7.76	2.39				0.00	0.00
132R-8, 103	823.23	c/s	o	38.76	11.28	0.00	0.00	18.27	16.80	0.19	0.85	1.02	0.06	87.23	7.71	2.64				0.00	0.00
132R-8, 103	823.23	c/s	o	41.28	9.51	0.00	0.00	19.75	15.20	0.23	0.60	1.33	0.10	88.00	8.04	2.18				0.00	0.00
133-7, 107	832.33	c/s	v	32.58	16.26	0.01		26.07	14.42	0.31	0.37	0.10	0.01	90.13	6.27	3.68				0.00	
133-7, 107	832.33	c/s	v	29.80	13.40	0.00		21.69	14.66	0.36	0.46	0.02	0.02	80.42	6.49	3.44				0.00	
133-7, 107	832.33	c/s	v	30.58	14.77	0.00		23.39	13.85	0.28	0.26	0.05	0.00	83.19	6.38	3.63				0.00	
133-7, 107	832.33	c/s	v	31.27	15.52	0.00		23.95	14.08	0.28	0.45	0.07	0.01	85.63	6.34	3.70				0.00	
133-7, 107	832.33	c/s	v	28.26	12.78	0.00		19.37	14.58	0.35	0.45	0.05	0.01	75.85	6.54	3.48				0.00	
133-7, 107	832.33	c/s	v	30.81	14.23	0.00		22.11	13.93	0.30	0.39	0.04	0.00	81.81	6.53	3.55				0.00	
150R-3, 65	973.23	c/s	v	33.91	12.59	0.00	0.00	19.65	20.71	0.20	0.65	0.22	0.03	87.96	6.89	3.01				0.00	0.00
150R-3, 65	973.23	c/s	v	34.10	12.59	0.00	0.00	19.90	20.41	0.21	0.71	0.23	0.01	88.16	6.90	3.00				0.00	0.00
150R-3, 65	973.23	c/s	v	34.36	12.43	0.00	0.00	19.67	20.96	0.20	0.80	0.13	0.04	88.59	6.94	2.96				0.00	0.00
150R-3, 65	973.23	c/s	v	38.87	10.23	0.00	0.00	17.54	18.77	0.11	1.96	0.68	0.06	88.22	7.74	2.40				0.00	0.00
168R-3, 71	1133.63	c/s	v	41.56	7.31	0.00	0.00	19.15	14.56	0.11	1.84	0.69	0.02	85.24	8.34	1.73				0.00	0.00
168R-7, 7	1138.75	c/s	o	33.52	14.43	0.00	0.00	27.18	10.97	0.08	0.34	0.08	0.02	86.62	6.57	3.33				0.00	0.00
168R-7, 7	1138.75	c/s	o	39.19	7.56	0.03	0.00	9.74	29.68	0.25	2.19	0.44	0.05	89.13	8.18	1.86				0.00	0.00
168R-7, 7	1138.75	c/s	o	37.19	7.52	0.04	0.00	7.11	32.11	0.23	1.72	0.63	0.08	86.63	8.14	1.94				0.01	0.00
168R-7, 7	1138.75	c/s	o	38.92	7.34	0.02	0.00	7.99	31.04	0.25	2.12	0.31	0.08	88.07	8.28	1.84				0.00	0.00
172-7, 132	1178.10	Chlorite	v	26.19	12.30	0.05		22.85	15.25	0.35	0.26	0.01	0.02	77.27	6.04	3.34				0.01	
172-7, 132	1178.10	Chlorite	v	24.99	14.58	0.02		23.93	13.38	0.34	0.15	0.04	0.00	77.44	5.69	3.91				0.00	

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	Mineral	Occurrence	Mg	Fe	Mn	Ca	Na	K	Oct total	Ca + Na + K	Fe/ Fe+Mg
176-735B-												
91R-3, 100	520.98	c/s	o	9.36	1.21	0.00	0.04	0.01	0.00	11.95	0.05	0.11
91R-3, 100	520.98	c/s	o	8.85	1.17	0.00	0.01	0.02	0.00	11.76	0.04	0.12
93R-1, 86	532.99	c/s	o	9.45	0.95	0.00	0.01	0.00	0.01	11.92	0.03	0.09
102R-3, 1	592.83	c/s	v	7.04	1.88	0.03	0.06	0.08	0.03	11.27	0.16	0.21
102R-3, 1	592.83	c/s	v	5.47	3.41	0.01	0.13	0.32	0.08	10.97	0.53	0.38
103R-2, 139	597.60	Chlorite	v	5.95	3.70	0.06	0.00	0.00	0.00	11.95	0.00	0.38
103R-2, 139	597.60	Chlorite	c	5.65	3.95	0.05	0.04	0.02	0.01	11.90	0.06	0.41
103R-4, 18	599.35	c/s	v	6.27	3.21	0.05	0.05	0.15	0.01	11.40	0.21	0.34
103R-4, 18	599.35	c/s	v	5.35	2.85	0.03	0.09	0.43	0.02	10.59	0.54	0.35
103R-4, 18	599.35	c/s	v	5.04	2.96	0.03	0.06	0.43	0.02	10.49	0.51	0.37
107-1, 8	620.31	c/s	v	6.27	3.40	0.03	0.12	0.02	0.01	11.32	0.15	0.35
107-1, 8	620.31	c/s	v	6.06	3.20	0.05	0.18	0.02	0.02	11.08	0.22	0.35
107-1, 8	620.31	c/s	v	5.99	3.15	0.03	0.15	0.03	0.02	11.04	0.20	0.34
107-1, 8	620.31	c/s	v	5.86	3.10	0.04	0.16	0.03	0.02	10.93	0.21	0.35
107-1, 8	620.31	c/s	v	5.86	2.99	0.03	0.19	0.03	0.02	8.88	0.23	0.34
118-1, 8	690.88	Chlorite	o	7.62	2.03	0.02	0.03	0.01	0.23	11.71	0.27	0.21
127R-5, 12	770.69	c/s	v	6.54	3.28	0.05	0.03	0.02	0.00	11.77	0.05	0.33
127R-5, 12	770.69	Chlorite	v	5.69	3.73	0.06	0.01	0.02	0.00	11.85	0.03	0.40
132R-1, 70	813.94	c/s	o	6.25	3.18	0.04	0.07	0.05	0.00	11.50	0.12	0.34
132R-1, 70	813.94	c/s	v	6.20	3.21	0.05	0.07	0.05	0.00	11.51	0.12	0.34
132R-1, 70	813.94	c/s	o	6.22	3.20	0.04	0.07	0.05	0.00	11.48	0.12	0.34
132R-1, 70	813.94	c/s	v	4.81	3.94	0.03	0.17	0.13	0.01	11.00	0.31	0.45
132R-8, 103	823.23	c/s	o	6.18	3.98	0.03	0.04	0.05	0.00	11.82	0.09	0.39
132R-8, 103	823.23	c/s	v	5.57	3.36	0.04	0.12	0.21	0.00	11.05	0.33	0.38
132R-8, 103	823.23	c/s	o	5.73	2.93	0.04	0.13	0.26	0.02	10.87	0.40	0.34
132R-8, 103	823.23	c/s	c	5.49	3.05	0.05	0.17	0.12	0.02	10.81	0.31	0.36
132R-8, 103	823.23	c/s	o	5.69	2.84	0.02	0.16	0.35	0.02	10.70	0.53	0.33
132R-8, 103	823.23	c/s	o	5.42	2.79	0.03	0.18	0.39	0.02	10.59	0.58	0.34
132R-8, 103	823.23	c/s	o	5.74	2.48	0.04	0.13	0.50	0.02	8.25	0.65	0.30
133-7, 107	832.33	c/s	v	7.47	2.31	0.05	0.08	0.04	0.00	11.79	0.12	0.24
133-7, 107	832.33	c/s	v	7.03	2.66	0.07	0.11	0.01	0.01	11.68	0.12	0.27
133-7, 107	832.33	c/s	v	7.27	2.41	0.05	0.06	0.02	0.00	11.74	0.08	0.25
133-7, 107	832.33	c/s	v	7.23	2.38	0.05	0.10	0.03	0.00	11.70	0.13	0.25
133-7, 107	832.33	c/s	v	6.68	2.82	0.07	0.11	0.02	0.00	11.59	0.14	0.30
133-7, 107	832.33	c/s	v	6.99	2.46	0.05	0.09	0.02	0.00	11.59	0.11	0.26
150R-3, 65	973.23	c/s	v	5.95	3.52	0.03	0.14	0.09	0.01	11.41	0.23	0.37
150R-3, 65	973.23	c/s	v	6.00	3.45	0.04	0.15	0.09	0.00	11.40	0.25	0.37
150R-3, 65	973.23	c/s	v	5.92	3.54	0.03	0.17	0.05	0.01	11.38	0.23	0.37
150R-3, 65	973.23	c/s	v	5.21	3.13	0.02	0.42	0.26	0.02	10.50	0.69	0.38
168R-3, 71	1133.63	c/s	v	5.73	2.44	0.02	0.40	0.27	0.01	8.19	0.67	0.30
168R-7, 7	1138.75	c/s	o	7.95	1.80	0.01	0.07	0.03	0.01	9.76	0.11	0.18
168R-7, 7	1138.75	c/s	o	3.03	5.18	0.04	0.49	0.18	0.01	8.26	0.68	0.63
168R-7, 7	1138.75	c/s	o	2.32	5.88	0.04	0.40	0.26	0.02	8.25	0.69	0.72
168R-7, 7	1138.75	c/s	o	2.54	5.53	0.05	0.48	0.13	0.02	8.11	0.63	0.69
172-7, 132	1178.10	Chlorite	v	7.84	2.93	0.07	0.06	0.00	0.01	12.22	0.07	0.27
172-7, 132	1178.10	Chlorite	v	8.11	2.54	0.06	0.04	0.02	0.00	12.31	0.05	0.24

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	Mineral	Occurrence	SiO_2	Al_2O_3	TiO_2	Cr_2O_3	MgO	FeO	MnO	CaO	Na_2O	K_2O	Total	Formula (28 Ox) Si	Formula (28 Ox) Al total	Formula (22 Ox) Si	Formula (22 Ox) Al tet	Formula (22 Ox) Al total	Ti	Cr
172-7, 132	1178.10	Chlorite	v	27.18	12.96	0.03		23.26	15.12	0.34	0.22	0.02	0.03	79.15	6.08	3.41				0.00	
172-7, 132	1178.10	c/s	v	26.55	11.42	0.05		20.34	16.15	0.29	0.34	0.03	0.00	75.16	6.32	3.20				0.01	
172-7, 132	1178.10	c/s	v	35.26	10.79	0.00		24.46	15.21	0.25	0.53	0.09	0.01	86.59	7.07	2.55				0.00	
172-7, 132	1178.10	Chlorite	v	29.34	15.85	0.04		25.61	10.55	0.35	0.23	0.02	0.02	82.02	6.12	3.89				0.01	
172-7, 132	1178.10	Chlorite	v	29.47	16.03	0.05		25.55	10.84	0.34	0.18	0.01	0.01	82.47	6.12	3.92				0.01	
172-7, 132	1178.10	c/s	v	34.69	7.89	0.02		18.73	12.99	0.19	0.68	0.03	0.02	75.25	7.90	2.11				0.00	
172-7, 132	1178.10	c/s	o	42.29	1.26	0.00		20.41	11.67	0.15	0.28	0.08	0.03	76.17	9.29	0.33				0.00	
172-7, 132	1178.10	c/s	v	37.41	6.67	0.00		20.60	11.17	0.19	1.19	0.12	0.03	77.37	8.17	1.72				0.00	
172-7, 132	1178.10	c/s	v	38.30	8.03	0.00		21.53	11.35	0.13	1.03	0.08	0.01	80.47	8.03	1.98				0.00	
172-7, 132	1178.10	c/s	v	37.45	6.84	0.05		19.22	11.72	0.21	1.12	0.09	0.03	76.72	8.26	1.78				0.01	
173R-4, 105	1183.73	c/s	v	35.07	12.79	0.00	0.00	22.63	15.17	0.12	0.29	0.42	0.00	86.49	7.02	3.01				0.00	0.00
173R-4, 105	1183.73	c/s	o	39.43	8.59	0.00	0.00	19.77	20.83	0.10	0.35	0.19	0.00	89.26	7.80	2.00				0.00	0.00
173R-4, 105	1183.73	c/s	o	33.00	11.93	0.03	0.00	13.49	27.71	0.19	0.75	0.63	0.05	87.78	7.00	2.98				0.00	0.00
173R-4, 105	1183.73	c/s		46.11	6.69	0.00	0.00	22.76	15.99	0.09	0.26	0.21	0.00	92.11	8.50	1.45				0.00	0.00
173R-4, 105	1183.73	c/s	v	38.71	11.56	0.00	0.00	21.32	13.95	0.11	0.61	1.42	0.05	87.73	7.56	2.66				0.00	0.00
188R-7, 101	1316.39	c/s	o	33.74	10.31	0.04	0.00	19.60	24.01	0.17	0.39	0.05	0.00	88.31	6.96	2.51				0.01	0.00
188R-7, 101	1316.39	c/s	o	41.06	6.56	0.05	0.04	21.39	18.65	0.13	1.44	0.34	0.00	89.66	8.02	1.51				0.01	0.01
188R-7, 101	1385.10	c/s	v	31.52	13.79	0.00		25.85	15.03	0.28	0.31	0.05	0.01	86.84	6.35	3.27				0.00	
197-2, 34	1385.10	c/s	v	31.72	15.17	0.00		21.34	21.81	0.33	0.60	0.08	0.01	91.07	6.29	3.54				0.00	
197-2, 34	1385.10	Chlorite	v	30.00	15.94	0.06		19.43	23.38	0.34	0.42	0.06	0.01	89.62	6.11	3.82				0.01	
197-2, 34	1385.10	c/s	v	37.41	13.69	0.01		27.87	15.23	0.18	0.44	0.08	0.00	94.90	6.80	2.93				0.00	
197-2, 34	1385.10	c/s	v	34.50	15.21	0.03		26.71	14.07	0.31	0.42	0.07	0.02	91.32	6.52	3.38				0.00	
197-2, 34	1385.10	c/s	v	34.03	14.33	0.02		25.16	14.95	0.24	0.84	0.10	0.00	89.66	6.59	3.27				0.00	
197-2, 34	1385.10	c/s	v	39.54	10.28	0.09		22.26	16.71	0.26	0.97	0.04	0.05	90.21	7.59	2.33				0.01	
197-2, 34	1385.10	c/s	o	42.61	7.72	0.00		21.91	13.98	0.24	0.84	0.08	0.06	87.45	8.26	1.76				0.00	
197-2, 34	1385.10	c/s	o	45.18	6.02	0.02		22.34	13.62	0.19	0.61	0.06	0.04	88.08	8.63	1.35				0.00	
197-2, 34	1423.90	c/s	v	33.18	13.06	0.00		32.02	10.61	0.25	0.17	0.05	0.00	89.35	6.34	2.94				0.00	
202-2, 135	1423.90	Chlorite	v	29.83	13.87	0.05		26.40	14.13	0.24	0.21	0.04	0.00	84.78	6.15	3.37				0.01	
202-2, 135	1423.90	c/s	v	32.37	12.03	0.01		26.55	12.50	0.20	0.47	0.06	0.00	84.18	6.63	2.90				0.00	
202-2, 135	1423.90	c/s	v	29.91	14.49	0.02		24.69	13.99	0.22	0.27	0.05	0.00	83.64	6.23	3.55				0.00	
202-2, 135	1423.90	c/s	v	32.68	14.25	0.04		23.80	12.79	0.22	1.21	0.03	0.00	85.03	6.62	3.40				0.01	
202-2, 135	1474.90	c/s	o	32.32	12.90	0.02		23.82	18.15	0.25	0.30	0.02	0.02	87.79	6.53	3.07				0.00	
207-5, 53	1474.90	c/s	v	33.19	12.41	0.00		23.80	17.46	0.30	0.40	0.06	0.01	87.62	6.68	2.94				0.00	
207-5, 53	1474.90	c/s	v	35.51	10.01	0.00		22.27	15.18	0.29	0.76	0.04	0.00	84.05	7.33	2.43				0.00	
207-5, 53	1474.90	c/s	v	38.01	9.74	0.03		23.34	15.22	0.21	0.90	0.06	0.01	87.53	7.50	2.26				0.00	
207-5, 53	1474.90	c/s	o	35.67	11.27	0.00		21.23	16.66	0.19	0.80	0.03	0.03	85.88	7.25	2.70				0.00	
207-5, 53	1474.90	c/s	v	37.47	9.68	0.00		22.10	15.34	0.24	0.91	0.06	0.00	85.80	7.55	2.30				0.00	
207-5, 53	1474.90	c/s	o	34.90	10.65	0.00		20.93	15.20	0.21	0.84	0.05	0.04	82.84	7.31	2.63				0.00	
207-5, 53	1474.90	c/s	v	37.32	8.46	0.05		20.76	12.63	0.20	1.09	0.05	0.02	80.57	7.89	2.11				0.01	
207-5, 53	1474.90	c/s	v	36.63	11.44	0.06		22.05	9.38	0.26	1.72	0.11	0.01	81.67	7.52	2.77				0.01	
207-5, 53	1474.90	c/s	v	37.03	10.69	0.00		22.22	9.03	0.20	1.82	0.11	0.00	81.09	7.63	2.60				0.00	
207-5, 53	1474.90	c/s	v	40.13	12.66	0.01		22.58	10.00	0.21	2.08	0.13	0.01	87.80	7.64	2.84				0.00	
207-5, 53	1475.96	c/s	v	34.39	12.70	0.01	0.00	28.74	9.81	0.11	0.12	0.13	0.00	86.01	6.75	2.94				0.00	0.00
207R-6, 1	1475.96*	c/s	v	32.16	13.06	0.01	0.00	20.85	21.12	0.21	0.29	0.18	0.00	87.88	6.58	3.15				0.00	0.00
207R-6, 1	1475.96†	c/s	v	33.94	13.77	0.00	0.00	27.86	10.50	0.15	0.19	0.09	0.00	86.50	6.65	3.18				0.00	0.00
207R-6, 1	1475.96	Chlorite	v	29.79	16.13	0.04	0.00	21.61	18.20	0.36	0.25	0.08	0.00	86.46	6.12	3.91				0.01	0.00
207R-6, 1	1475.96	c/s	v	33.69	14.25	0.00	0.00	27.32	10.72	0.23	0.33	0.38	0.00	86.92	6.59	3.28				0.00	0.00

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	Mineral	Occurrence	Mg	Fe	Mn	Ca	Na	K	Oct total	Ca + Na + K	Fe/ Fe+Mg
172-7, 132	1178.10	Chlorite	v	7.76	2.82	0.06	0.05	0.01	0.01	12.15	0.07	0.27
172-7, 132	1178.10	c/s	v	7.20	3.20	0.06	0.09	0.01	0.00	11.99	0.10	0.31
172-7, 132	1178.10	c/s	v	7.31	2.54	0.04	0.11	0.03	0.00	11.52	0.15	0.26
172-7, 132	1178.10	Chlorite	v	7.96	1.84	0.06	0.05	0.01	0.01	11.87	0.07	0.19
172-7, 132	1178.10	Chlorite	v	7.90	1.88	0.06	0.04	0.00	0.00	11.88	0.05	0.19
172-7, 132	1178.10	c/s	v	6.35	2.47	0.04	0.17	0.01	0.01	10.87	0.19	0.28
172-7, 132	1178.10	c/s	o	6.68	2.14	0.03	0.07	0.04	0.01	8.85	0.11	0.24
172-7, 132	1178.10	c/s	v	6.70	2.04	0.03	0.28	0.05	0.01	8.77	0.34	0.23
172-7, 132	1178.10	c/s	v	6.72	1.98	0.02	0.23	0.03	0.00	8.73	0.27	0.23
172-7, 132	1178.10	c/s	v	6.32	2.16	0.04	0.26	0.04	0.01	8.52	0.31	0.25
173R-4, 105	1183.73	c/s	v	6.75	2.54	0.02	0.06	0.16	0.00	11.34	0.22	0.27
173R-4, 105	1183.73	c/s	o	5.83	3.45	0.02	0.07	0.07	0.00	11.09	0.15	0.37
173R-4, 105	1183.73	c/s	o	4.27	4.92	0.03	0.17	0.26	0.01	11.20	0.44	0.54
173R-4, 105	1183.73	c/s		6.25	2.46	0.01	0.05	0.07	0.00	8.73	0.13	0.28
173R-4, 105	1183.73	c/s	v	6.20	2.28	0.02	0.13	0.53	0.01	10.72	0.67	0.27
188R-7, 101	1316.39	c/s	o	6.03	4.14	0.03	0.09	0.02	0.00	11.68	0.11	0.41
188R-7, 101	1316.39	c/s	o	6.23	3.05	0.02	0.30	0.13	0.00	9.31	0.43	0.33
188R-7, 101	1385.10	c/s	v	7.75	2.52	0.05	0.07	0.02	0.00	11.94	0.09	0.25
197-2, 34	1385.10	c/s	v	6.30	3.61	0.06	0.13	0.03	0.00	11.80	0.16	0.36
197-2, 34	1385.10	Chlorite	v	5.90	3.97	0.06	0.09	0.02	0.00	11.87	0.11	0.40
197-2, 34	1385.10	c/s	v	7.55	2.31	0.03	0.09	0.03	0.00	11.63	0.12	0.23
197-2, 34	1385.10	c/s	v	7.52	2.22	0.05	0.08	0.03	0.00	11.69	0.12	0.23
197-2, 34	1385.10	c/s	v	7.26	2.42	0.04	0.17	0.04	0.00	11.58	0.22	0.25
197-2, 34	1385.10	c/s	v	6.37	2.68	0.04	0.20	0.02	0.01	11.02	0.23	0.30
197-2, 34	1385.10	c/s	o	6.33	2.26	0.04	0.18	0.03	0.01	8.63	0.23	0.26
197-2, 34	1385.10	c/s	o	6.36	2.17	0.03	0.13	0.02	0.01	8.56	0.16	0.25
197-2, 34	1423.90	c/s	v	9.12	1.69	0.04	0.03	0.02	0.00	12.14	0.06	0.16
202-2, 135	1423.90	Chlorite	v	8.11	2.43	0.04	0.05	0.02	0.00	12.11	0.06	0.23
202-2, 135	1423.90	c/s	v	8.10	2.14	0.03	0.10	0.02	0.00	11.80	0.12	0.21
202-2, 135	1423.90	c/s	v	7.66	2.43	0.04	0.06	0.02	0.00	11.92	0.08	0.24
202-2, 135	1423.90	c/s	v	7.18	2.16	0.04	0.26	0.01	0.00	11.41	0.27	0.23
202-2, 135	1474.90	c/s	o	7.17	3.06	0.04	0.06	0.01	0.01	11.87	0.08	0.30
207-5, 53	1474.90	c/s	v	7.14	2.93	0.05	0.09	0.02	0.00	11.75	0.11	0.29
207-5, 53	1474.90	c/s	v	6.85	2.61	0.05	0.17	0.02	0.00	11.28	0.18	0.28
207-5, 53	1474.90	c/s	v	6.86	2.50	0.03	0.19	0.02	0.00	11.16	0.22	0.27
207-5, 53	1474.90	c/s	o	6.42	2.82	0.03	0.17	0.01	0.01	11.22	0.19	0.31
207-5, 53	1474.90	c/s	v	6.63	2.58	0.04	0.20	0.02	0.00	11.09	0.22	0.28
207-5, 53	1474.90	c/s	o	6.53	2.66	0.04	0.19	0.02	0.01	11.17	0.21	0.29
207-5, 53	1474.90	c/s	v	6.54	2.23	0.04	0.25	0.02	0.01	10.80	0.26	0.25
207-5, 53	1474.90	c/s	v	6.74	1.61	0.05	0.38	0.04	0.00	10.69	0.41	0.19
207-5, 53	1474.90	c/s	v	6.83	1.55	0.03	0.40	0.04	0.00	10.64	0.43	0.19
207-5, 53	1474.90	c/s	v	6.40	1.59	0.03	0.42	0.05	0.00	10.50	0.49	0.20
207-5, 53	1475.96	c/s	v	8.41	1.61	0.02	0.03	0.05	0.00	11.73	0.07	0.16
207R-6, 1	*	c/s	v	6.36	3.61	0.04	0.06	0.07	0.00	11.74	0.13	0.36
207R-6, 1	†	c/s	v	8.14	1.72	0.02	0.04	0.03	0.00	11.71	0.07	0.17
207R-6, 1	1475.96	Chlorite	v	6.62	3.13	0.06	0.06	0.03	0.00	11.85	0.09	0.32
207R-6, 1	1475.96	c/s	v	7.97	1.75	0.04	0.07	0.14	0.00	11.63	0.21	0.18

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	Mineral	Occurrence	SiO_2	Al_2O_3	TiO_2	Cr_2O_3	MgO	FeO	MnO	CaO	Na_2O	K_2O	Total	Formula (28 Ox) Si	Formula (28 Ox) Al total	Formula (22 Ox) Si	Formula (22 Ox) Al tet	Formula (22 Ox) Al total	Ti	Cr
207R-6, 1	1475.96	c/s	v	34.99	12.91	0.00	0.01	26.66	11.95	0.12	0.59	0.50	0.00	87.73	6.82	2.96				0.00	0.00
207R-6, 1	1475.96	c/s	v	34.82	13.37	0.02	0.00	26.20	11.70	0.12	0.49	0.28	0.00	87.00	6.82	3.08				0.00	0.00
207R-6, 1	1475.96	c/s	v	35.00	13.05	0.00	0.00	25.97	11.89	0.17	0.59	0.45	0.00	87.12	6.86	3.01				0.00	0.00
207R-6, 1	1475.96	c/s	v	36.58	11.10	0.05	0.00	19.71	20.46	0.18	0.59	0.25	0.00	88.92	7.30	2.61				0.01	0.00
207R-6, 1	1493.67	Chlorite	c	27.53	19.27	0.12	0.01	20.35	19.34	0.15	0.21	0.01	0.00	86.99	5.66	4.67				0.02	0.00
209R-4, 103	1493.67	Chlorite	p	28.87	18.70	0.03	0.00	23.16	15.71	0.11	0.12	0.00	0.00	86.70	5.83	4.45				0.00	0.00
209R-4, 103	1493.67	Chlorite	o	29.42	18.27	0.05	0.00	24.67	13.58	0.10	0.05	0.01	0.00	86.15	5.91	4.32				0.01	0.00
209R-4, 103	1493.67	Chlorite	o	29.04	19.30	0.04	0.02	24.32	13.56	0.07	0.06	0.00	0.00	86.41	5.81	4.55				0.01	0.00
209R-4, 103	1493.67	Chlorite	o	28.73	18.74	0.06	0.00	22.27	16.39	0.17	0.09	0.00	0.00	86.45	5.84	4.49				0.01	0.00
209R-4, 103	1493.67	Chlorite	o	29.31	18.77	0.05	0.00	24.11	14.04	0.10	0.08	0.00	0.00	86.46	5.87	4.43				0.01	0.00
209R-4, 103	1493.67	Chlorite	p	28.72	18.99	0.02	0.00	22.60	15.77	0.17	0.18	0.03	0.00	86.48	5.82	4.53				0.00	0.00
209R-4, 103	1493.67	Chlorite	p	29.62	18.26	0.01	0.02	22.95	15.73	0.15	0.18	0.01	0.00	86.93	5.96	4.33				0.00	0.00
209R-4, 103	1493.67	Chlorite	p	29.60	18.04	0.02	0.00	22.81	15.74	0.12	0.18	0.04	0.00	86.55	5.98	4.29				0.00	0.00
209R-4, 103	1493.67	c/s	c	32.27	15.11	0.05	0.01	21.58	16.73	0.15	0.63	0.20	0.00	86.73	6.53	3.60				0.01	0.00
209R-4, 103	532.99	Alt phlog	o	37.10	19.55	0.05	0.04	20.64	9.57	0.06	0.53	2.69	3.06	93.29	5.34	3.32				0.01	
93R-1, 86	532.99	Alt phlog	o	32.06	18.09	0.03	0.08	17.20	18.78	0.23	0.03	0.21	3.69	90.40	5.03	3.34				0.00	
93R-1, 86	532.99	Alt phlog	p-o	31.53	19.47	0.04	0.00	23.66	9.04	0.08	1.11	0.74	1.13	86.80	4.85	3.53				0.00	
93R-1, 86	532.99	Alt phlog	o	31.84	17.69	0.06	0.07	18.63	19.01	0.26	0.12	0.18	3.14	91.00	4.96	3.25				0.01	
93R-1, 86	532.99	Alt phlog	o	32.13	18.89	0.00	0.00	19.92	15.76	0.10	0.20	0.24	2.38	89.62	4.96	3.43				0.00	
93R-1, 86	532.99	Alt phlog	o	35.25	18.85	0.07	0.00	21.20	10.85	0.17	0.12	1.05	3.32	90.88	5.24	3.30				0.01	
93R-1, 86	532.99	Alt phlog	o	35.67	18.44	0.19	0.00	23.28	8.34	0.07	0.46	0.81	3.52	90.78	5.25	3.20				0.02	
93R-1, 86	532.99	Alt phlog	p-o	33.85	20.26	0.02	0.00	22.77	7.84	0.04	1.24	2.19	1.22	89.43	5.02	3.54				0.00	
93R-1, 86	532.99	Alt phlog	o	35.03	19.48	0.27	0.00	20.77	11.08	0.08	0.35	1.70	2.96	91.72	5.17	3.39				0.03	
93R-1, 86	532.99	Alt phlog	o	37.84	18.97	0.00	0.00	17.33	10.08	0.03	0.18	3.01	0.12	87.56	5.68	3.35				0.00	
93R-1, 86	592.83	Alt phlog	amp	37.66	10.89	0.00	0.00	15.89	20.40	0.06	0.26	0.81	0.56	86.53	6.06	2.06				0.00	
103R-2, 139	597.60	Alt phlog	p-o	36.56	17.13	0.00	0.00	22.40	9.09	0.04	0.04	0.18	5.46	90.90	5.43	3.00				0.00	
102R-3, 1	592.83	nontronite	amp	49.76	7.41	0.04	0.00	3.39	27.94	0.02	0.45	1.86	2.58	93.45			7.55	0.45	1.32	0.00	
102R-3, 1	592.83	Nontronite	o	43.24	2.36	0.00	0.01	3.45	27.97	0.00	0.23	1.59	2.83	81.68			7.75	0.25	0.50	0.00	
181-2, 7	1241.70	Mg-mont	v	48.48	19.62	0.03		4.84	3.89	0.02	0.40	2.97	0.02	80.27			7.33	0.67	3.50	0.00	
181-2, 7	1241.70	Mg-mont	v	53.22	18.87	0.02		8.00	3.73	0.11	0.66	1.73	0.03	86.37			7.44	0.56	3.11	0.00	
107-1, 8	620.31	Smectite	v	39.97	6.10	0.00		18.95	11.80	0.10	0.95	0.06	0.11	78.06			6.76	1.22	1.22	0.00	
107-1, 8	620.31	Smectite	v	36.62	4.92	0.00		15.62	11.30	0.09	0.81	0.05	0.15	69.55			6.96	1.10	1.10	0.00	
118-1, 8	690.88	Smectite	o	42.10	5.05	0.03		20.39	7.99	0.00	0.51	0.29	0.17	76.54			7.06	0.94	1.00	0.00	
118-1, 8	690.88	Smectite	o	41.13	3.13	0.01		16.47	9.48	0.05	0.72	0.21	0.38	71.59			7.45	0.55	0.67	0.00	
118-1, 8	690.88	Smectite	v	48.30	3.70	0.00		18.06	15.01	0.25	0.92	0.16	0.19	86.60			7.38	0.62	0.67	0.00	
118-1, 8	690.88	Smectite	v	47.18	2.78	0.03		18.11	13.70	0.21	0.67	0.21	0.21	83.09			7.47	0.52	0.52	0.00	
118-1, 8	690.88	Smectite	v	45.34	2.77	0.00		16.68	14.63	0.30	0.76	0.18	0.21	80.87			7.44	0.54	0.54	0.00	
118-1, 8	690.88	Smectite	v	39.91	6.50	0.04		17.70	12.71	0.08	1.94	0.27	0.16	79.32			6.71	1.29	1.29	0.01	
118-1, 8	690.88	Smectite	v	41.16	6.46	0.01		18.14	11.92	0.09	1.28	0.20	0.19	79.45			6.84	1.16	1.26	0.00	
127R-5, 12	770.69	Smectite	c	48.73	2.86	0.00	0.00	20.02	7.10	0.02	0.74	0.83	0.17	80.47			7.66	0.34	0.53	0.00	
127R-5, 12	770.69	Smectite	v	44.69	6.59	0.00	0.00	19.24	11.60	0.10	1.08	0.76	0.03	84.09			6.95	1.05	1.21	0.00	
132R-8, 103	823.23	Smectite	c	46.75	5.42	0.00	0.00	14.35	19.00	0.45	1.71	0.80	0.20	88.68			7.17	0.83	0.98	0.00	
150R-3, 65	973.23	Smectite	v	43.59	4.63	0.00	0.00	15.15	17.19	0.09	1.76	0.59	0.08	83.08			7.11	0.89	0.89	0.00	
168R-3, 71	1133.63	Smectite	v	46.96	10.26	0.00	0.00	11.49	14.05	0.15	1.63	0.35	0.03	84.92			7.22	0.78	1.86	0.00	
168R-3, 71	1133.63	Smectite	v	48.29	8.46	0.00	0.00	21.48	8.05	0.17	2.10	0.97	0.02	89.54			6.92	1.08	1.43	0.00	
168R-3, 71	1133.63	Smectite	v	42.52	10.56	0.00	0.00	16.08	14.25	0.14	1.48	0.67	0.03	85.73			6.59	1.41	1.93	0.00	
168R-3, 71	1133.63	Smectite	v	43.83	8.36	0.06	0.00	20.41	12.78	0.13	1.71	0.93	0.03	88.24			6.58	1.42	1.48	0.01	

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	Mineral	Occurrence	Mg	Fe	Mn	Ca	Na	K	Oct total	Ca + Na + K	Fe/ Fe+Mg
207R-6, 1	1475.96	c/s	v	7.74	1.95	0.02	0.12	0.19	0.00	11.49	0.31	0.20
207R-6, 1	1475.96	c/s	v	7.65	1.92	0.02	0.10	0.10	0.00	11.48	0.21	0.20
207R-6, 1	1475.96	c/s	v	7.58	1.95	0.03	0.12	0.17	0.00	11.43	0.29	0.20
207R-6, 1	1475.96	c/s	v	5.86	3.41	0.03	0.13	0.10	0.00	11.22	0.22	0.37
207R-6, 1	1493.67	Chlorite	c	6.24	3.33	0.03	0.05	0.00	0.00	11.94	0.05	0.35
209R-4, 103	1493.67	Chlorite	p	6.97	2.65	0.02	0.03	0.00	0.00	11.92	0.03	0.28
209R-4, 103	1493.67	Chlorite	o	7.38	2.28	0.02	0.01	0.00	0.00	11.92	0.01	0.24
209R-4, 103	1493.67	Chlorite	o	7.25	2.27	0.01	0.01	0.00	0.00	11.90	0.01	0.24
209R-4, 103	1493.67	Chlorite	o	6.75	2.79	0.03	0.02	0.00	0.00	11.89	0.02	0.29
209R-4, 103	1493.67	Chlorite	o	7.20	2.35	0.02	0.02	0.00	0.00	11.89	0.02	0.25
209R-4, 103	1493.67	Chlorite	p	6.82	2.67	0.03	0.04	0.01	0.00	11.87	0.05	0.28
209R-4, 103	1493.67	Chlorite	p	6.88	2.65	0.03	0.04	0.00	0.00	11.84	0.04	0.28
209R-4, 103	1493.67	Chlorite	p	6.87	2.66	0.02	0.04	0.02	0.00	11.83	0.05	0.28
209R-4, 103	1493.67	c/s	c	6.51	2.83	0.03	0.14	0.08	0.00	11.49	0.21	0.30
209R-4, 103	532.99	Alt phlog	o	4.43	1.15	0.01	0.08	0.74	0.56	6.26	1.39	
93R-1, 86	532.99	Alt phlog	o	4.02	2.46	0.03	0.01	0.06	0.74	6.88	0.81	
93R-1, 86	532.99	Alt phlog	p-o	5.43	1.16	0.01	0.18	0.22	0.22	6.98	0.62	
93R-1, 86	532.99	Alt phlog	o	4.32	2.48	0.03	0.02	0.05	0.62	7.04	0.70	
93R-1, 86	532.99	Alt phlog	o	4.58	2.03	0.01	0.03	0.07	0.47	7.02	0.57	
93R-1, 86	532.99	Alt phlog	o	4.70	1.35	0.02	0.02	0.30	0.63	6.62	0.95	
93R-1, 86	532.99	Alt phlog	o	5.11	1.03	0.01	0.07	0.23	0.66	6.62	0.96	
93R-1, 86	532.99	Alt phlog	p-o	5.04	0.97	0.01	0.20	0.62	0.23	6.58	1.05	
93R-1, 86	532.99	Alt phlog	o	4.57	1.37	0.01	0.06	0.48	0.56	6.54	1.09	
93R-1, 86	532.99	Alt phlog	o	3.88	1.26	0.00	0.03	0.86	0.02	6.17	0.92	
93R-1, 86	592.83	Alt phlog	amp	3.81	2.74	0.01	0.04	0.25	0.11	6.68	0.41	
103R-2, 139	597.60	Alt phlog	p-o	4.96	1.13	0.01	0.01	0.05	1.03	6.52	1.09	
102R-3, 1	592.83	nontronite	amp	0.77	3.55	0.00	0.07	0.54	0.50	5.19	1.11	
102R-3, 1	592.83	Nontronite	o	0.92	4.19	0.00	0.04	0.55	0.65	5.36	1.24	
181-2, 7	1241.70	Mg-mont	v	1.09	0.49	0.00	0.06	0.87	0.00	4.42	0.93	
181-2, 7	1241.70	Mg-mont	v	1.67	0.44	0.01	0.10	0.47	0.01	4.67	0.57	
107-1, 8	620.31	Smectite	v	4.78	1.67	0.01	0.17	0.02	0.02	6.46	0.22	
107-1, 8	620.31	Smectite	v	4.42	1.79	0.01	0.17	0.02	0.04	6.23	0.22	
118-1, 8	690.88	Smectite	o	5.09	1.12	0.00	0.09	0.09	0.04	6.28	0.22	
118-1, 8	690.88	Smectite	o	4.44	1.43	0.01	0.14	0.07	0.09	6.00	0.30	
118-1, 8	690.88	Smectite	v	4.11	1.91	0.03	0.15	0.05	0.04	6.10	0.23	
118-1, 8	690.88	Smectite	v	4.27	1.81	0.03	0.11	0.06	0.04	6.11	0.22	
118-1, 8	690.88	Smectite	v	4.08	2.00	0.04	0.13	0.06	0.04	6.12	0.23	
118-1, 8	690.88	Smectite	v	4.43	1.78	0.01	0.35	0.09	0.03	6.23	0.47	
118-1, 8	690.88	Smectite	v	4.49	1.65	0.01	0.23	0.07	0.04	6.25	0.33	
127R-5, 12	770.69	Smectite	c	4.69	0.93	0.00	0.12	0.25	0.03	5.81	0.41	
127R-5, 12	770.69	Smectite	v	4.46	1.51	0.01	0.18	0.23	0.01	6.15	0.41	
132R-8, 103	823.23	Smectite	c	3.28	2.44	0.06	0.28	0.23	0.04	5.92	0.55	
150R-3, 65	973.23	Smectite	v	3.68	2.34	0.01	0.31	0.18	0.02	6.04	0.51	
168R-3, 71	1133.63	Smectite	v	2.63	1.81	0.02	0.27	0.10	0.01	5.53	0.38	
168R-3, 71	1133.63	Smectite	v	4.59	0.96	0.02	0.32	0.27	0.00	5.91	0.59	
168R-3, 71	1133.63	Smectite	v	3.72	1.85	0.02	0.25	0.20	0.01	6.10	0.45	
168R-3, 71	1133.63	Smectite	v	4.57	1.61	0.02	0.28	0.27	0.01	6.26	0.55	

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	Mineral	Occurrence	SiO_2	Al_2O_3	TiO_2	Cr_2O_3	MgO	FeO	MnO	CaO	Na_2O	K_2O	Total	Formula (28 Ox) Si	Formula (28 Ox) Al total	Formula (22 Ox) Si	Formula (22 Ox) Al tet	Formula (22 Ox) Al total	Ti	Cr
168R-7, 7	1138.75	Smectite	c	45.57	4.84	0.00	0.00	15.64	17.23	0.12	1.79	0.72	0.09	86.00			7.15	0.85	0.89	0.00	
168R-7, 7	1138.75	Smectite	c	45.32	4.87	0.00	0.00	15.77	17.86	0.07	1.64	0.74	0.09	86.36			7.11	0.89	0.90	0.00	
172-7, 132	1178.10	Smectite	o	54.92	1.17	0.03		23.32	11.93	0.15	0.29	0.09	0.04	91.95			7.69	0.19	0.19	0.00	
172-7, 132	1178.10	Smectite	o	52.93	1.29	0.03		21.74	13.38	0.16	0.35	0.08	0.08	90.02			7.64	0.22	0.22	0.00	
177R-5, 50	1207.57	Smectite	v	48.43	9.82	0.00	0.00	24.89	2.48	0.16	2.38	1.95	0.00	90.11			6.75	1.25	1.61	0.00	
177R-5, 50	1207.57	Smectite	v	48.69	10.91	0.00	0.00	24.35	3.13	0.20	1.48	2.57	0.00	91.33			6.70	1.30	1.77	0.00	
177R-5, 50	1207.57	Smectite	v	49.35	8.39	0.00	0.00	26.22	1.16	0.19	2.03	1.76	0.00	89.10			6.89	1.11	1.38	0.00	
177R-5, 50	1207.57	Smectite	v	47.24	8.24	0.00	0.00	25.49	1.07	0.19	2.17	1.20	0.00	85.60			6.86	1.14	1.41	0.00	
177R-5, 50	1207.57	Smectite	o	47.55	5.51	0.03	0.01	20.10	12.02	0.03	1.24	0.72	0.00	87.21			7.12	0.88	0.97	0.00	
177R-5, 50	1207.57	Smectite	v	43.13	8.24	0.01	0.00	26.99	0.99	0.15	2.24	1.64	0.00	83.39			6.50	1.46	1.46	0.00	
177R-5, 50	1207.57	Smectite	v	42.14	8.85	0.00	0.00	25.40	5.71	0.11	1.96	1.95	0.00	86.12			6.32	1.56	1.56	0.00	
180R-4, 109	1235.92	Smectite	v	47.40	11.89	0.01	0.00	19.07	5.83	0.07	1.48	2.88	0.00	88.63			6.79	1.21	2.01	0.00	
180R-4, 109	1235.92	Smectite	v	43.27	9.99	0.01	0.00	25.62	1.67	0.18	2.59	2.03	0.00	85.36			6.40	1.60	1.74	0.00	
180R-4, 109	1235.92	Smectite	c	46.13	11.19	0.02	0.00	25.65	4.00	0.15	1.43	2.89	0.00	91.46			6.42	1.58	1.83	0.00	
180R-4, 109	1235.92	Smectite	v	41.83	9.08	0.01	0.00	24.80	2.40	0.16	2.60	1.67	0.00	82.55			6.43	1.57	1.64	0.00	
181-2, 7	1241.70	Smectite	v	44.12	7.71	0.00		23.66	6.48	0.18	1.48	0.16	0.03	83.82			6.72	1.28	1.38	0.00	
181-2, 7	1241.70	Smectite	v	43.63	6.82	0.03		23.49	6.88	0.17	1.46	0.07	0.04	82.58			6.77	1.23	1.25	0.00	
188R-7, 101	1316.39	Smectite	v	45.80	9.47	0.04	0.00	19.93	9.16	0.17	2.23	0.99	0.00	87.79			6.75	1.25	1.64	0.00	
188R-7, 101	1316.39	Smectite	v	44.16	9.25	0.02	0.00	20.96	8.02	0.11	2.35	1.18	0.00	86.05			6.64	1.36	1.64	0.00	
190R-2, 97	1328.23	Smectite	v	47.71	9.01	0.05	0.00	20.07	8.19	0.34	0.89	2.45	0.00	88.71			6.92	1.08	1.54	0.01	
91R-3, 100	520.98	Talc	c	59.30	0.19	0.00	0.00	31.08	3.19	0.00	0.01	0.03	0.00	93.80			7.77	0.03	0.03	0.00	
91R-3, 100	520.98	Talc	c	59.37	0.19	0.00	0.00	31.77	3.72	0.00	0.03	0.04	0.01	95.13			7.70	0.03	0.03	0.00	
93R-1, 86	532.99	Talc	v	60.02	3.18	0.07	0.00	28.93	3.46	0.02	0.00	0.26	0.03	95.97			7.67	0.33	0.48	0.01	
93R-1, 86	532.99	Talc	o	61.85	0.81	0.00	0.00	31.06	2.14	0.01	0.09	0.10	0.01	96.07			7.85	0.12	0.12	0.00	
103R-2, 139	597.60	Talc	o	62.62	0.15	0.00	0.00	29.47	2.34	0.00	0.00	0.10	0.00	94.68			8.03	0.02	0.02	0.00	
103R-2, 139	597.60	Talc	c	59.64	0.58	0.00	0.00	29.07	2.83	0.01	0.03	0.16	0.00	92.32			7.89	0.09	0.09	0.00	
103R-2, 139	597.60	Talc	o	61.40	0.00	0.00	0.00	31.65	2.74	0.03	0.00	0.01	0.00	95.83			7.84	0.00	0.00	0.00	
127R-5, 12	770.69	Talc	c	61.80	0.00	0.00	0.00	28.79	3.83	0.00	0.03	0.10	0.00	94.55			8.00	0.00	0.00	0.00	
127R-5, 12	770.69	Talc	c	61.31	0.00	0.00	0.00	28.46	5.88	0.04	0.04	0.06	0.00	95.79			7.93	0.00	0.00	0.00	
132R-1, 70	813.94	Talc	o	61.02	0.39	0.00	0.00	28.91	3.78	0.04	0.13	0.08	0.00	94.35			7.93	0.06	0.06	0.00	
150R-3, 65	973.23	Talc	v	57.79	2.20	0.00	0.00	29.08	4.44	0.02	0.22	0.31	0.00	94.06			7.61	0.34	0.34	0.00	
150R-3, 65	973.23	Talc	v	56.26	2.83	0.00	0.00	28.62	5.34	0.04	0.45	0.27	0.00	93.81			7.48	0.44	0.44	0.00	
168R-7, 7	1138.75	Talc	o	59.99	0.69	0.00	0.00	29.35	3.66	0.00	0.05	0.04	0.00	93.78			7.85	0.11	0.11	0.00	
173R-4, 105	1183.73	Talc	o	62.81	0.13	0.00	0.00	30.38	1.90	0.00	0.01	0.04	0.00	95.27			8.00	0.00	0.02	0.00	
173R-4, 105	1183.73	Talc	o	60.14	1.41	0.00	0.00	29.07	3.64	0.01	0.11	0.14	0.00	94.52			7.81	0.19	0.22	0.00	
91R-3, 100	520.98	Serpentine	c	38.99	1.24	0.00	0.00	32.30	13.73	0.06	0.16	0.30	0.02	86.80			6.11	0.23	0.23	0.00	0.00
91R-3, 100	520.98	Serpentine	c	39.49	1.44	0.01	0.00	30.89	15.21	0.01	0.11	0.16	0.23	87.55			6.17	0.27	0.27	0.00	
91R-3, 100	520.98	Serpentine	c	42.95	0.84	0.00	0.00	35.26	7.01	0.02	0.09	0.09	0.01	86.27			6.47	0.15	0.15	0.00	
91R-3, 100	520.98	Serpentine	c	44.84	1.14	0.00	0.00	36.21	6.45	0.01	0.07	0.02	0.01	88.75			6.53	0.20	0.20	0.00	
93R-1, 86	532.99	Serpentine	o	40.86	0.45	0.00	0.02	31.51	13.15	0.18	0.04	0.05	0.01	86.27			6.39	0.08	0.08	0.00	
177R-5, 50	1207.57	Serpentine	o	41.59	1.93	0.01	0.00	33.00	9.59	0.02	0.45	0.08	0.00	86.67			6.34	0.35	0.35	0.00	
173R-4, 105	1183.73	Serpentine	o	45.35	0.04	0.00	0.00	36.29	6.27	0.03	0.00	0.02	0.00	88.00			6.64	0.01	0.01	0.00	
103R-2, 139	597.60	Serpentine	o	44.00	0.10	0.00	0.00	35.58	5.62	0.09	0.09	0.04	0.01	85.53			6.62	0.02	0.02	0.00	

Notes: Mineral: c/s = chlorite/smectite, Mg-mont = Mg montmorillonite, all other smectites = saponite. Occurrence: o = olivine, v = vein, c = clinopyroxene, p = plagioclase, p-o = reaction rim between plagioclase and olivine. * = altered phlogopite. † = amphibole. Al tet = tetrahedral, Oct = octahedral.

Table T2 (continued).

Core, section, interval (cm)	Depth (mbsf)	Mineral	Occurrence	Mg	Fe	Mn	Ca	Na	K	Oct total	Ca + Na + K	Fe/ Fe+Mg
168R-7, 7	1138.75	Smectite	c	3.66	2.26	0.02	0.30	0.22	0.02	5.98	0.54	
168R-7, 7	1138.75	Smectite	c	3.69	2.34	0.01	0.28	0.22	0.02	6.05	0.52	
172-7, 132	1178.10	Smectite	o	4.86	1.39	0.02	0.04	0.03	0.01	6.28	0.08	
172-7, 132	1178.10	Smectite	o	4.68	1.61	0.02	0.05	0.02	0.01	6.31	0.09	
177R-5, 50	1207.57	Smectite	v	5.17	0.29	0.02	0.36	0.52	0.00	5.83	0.88	
177R-5, 50	1207.57	Smectite	v	5.00	0.36	0.02	0.22	0.68	0.00	5.85	0.90	
177R-5, 50	1207.57	Smectite	v	5.46	0.14	0.02	0.30	0.47	0.00	5.88	0.77	
177R-5, 50	1207.57	Smectite	v	5.52	0.13	0.02	0.34	0.33	0.00	5.93	0.67	
177R-5, 50	1207.57	Smectite	o	4.49	1.50	0.00	0.20	0.21	0.00	6.09	0.41	
177R-5, 50	1207.57	Smectite	v	6.06	0.12	0.02	0.36	0.47	0.00	6.21	0.83	
177R-5, 50	1207.57	Smectite	v	5.68	0.72	0.01	0.32	0.56	0.00	6.41	0.88	
180R-4, 109	1235.92	Smectite	v	4.07	0.70	0.01	0.23	0.79	0.00	5.58	1.02	
180R-4, 109	1235.92	Smectite	v	5.65	0.21	0.02	0.41	0.58	0.00	6.03	0.99	
180R-4, 109	1235.92	Smectite	c	5.32	0.47	0.02	0.21	0.77	0.00	6.06	0.98	
180R-4, 109	1235.92	Smectite	v	5.68	0.31	0.02	0.43	0.49	0.00	6.08	0.92	
181-2, 7	1241.70	Smectite	v	5.37	0.82	0.02	0.24	0.05	0.01	6.32	0.29	
181-2, 7	1241.70	Smectite	v	5.43	0.89	0.02	0.24	0.02	0.01	6.35	0.27	
188R-7, 101	1316.39	Smectite	v	4.38	1.13	0.02	0.35	0.28	0.00	5.93	0.63	
188R-7, 101	1316.39	Smectite	v	4.70	1.01	0.01	0.38	0.34	0.00	5.99	0.72	
190R-2, 97	1328.23	Smectite	v	4.34	0.99	0.04	0.14	0.68	0.00	5.83	0.82	
91R-3, 100	520.98	Talc	c	6.07	0.35	0.00	0.00	0.01	0.00	6.42	0.01	
91R-3, 100	520.98	Talc	c	6.14	0.40	0.00	0.00	0.01	0.00	6.55	0.02	
93R-1, 86	532.99	Talc	v	5.51	0.37	0.00	0.00	0.06	0.00	6.05	0.07	
93R-1, 86	532.99	Talc	o	5.87	0.23	0.00	0.01	0.02	0.00	6.10	0.04	
103R-2, 139	597.60	Talc	o	5.64	0.25	0.00	0.00	0.02	0.00	5.89	0.02	
103R-2, 139	597.60	Talc	c	5.74	0.31	0.00	0.00	0.04	0.00	6.05	0.04	
103R-2, 139	597.60	Talc	o	6.02	0.29	0.00	0.00	0.00	0.00	6.32	0.00	
127R-5, 12	770.69	Talc	c	5.56	0.41	0.00	0.00	0.02	0.00	5.97	0.03	
127R-5, 12	770.69	Talc	c	5.49	0.64	0.00	0.01	0.01	0.00	6.13	0.02	
132R-1, 70	813.94	Talc	o	5.60	0.41	0.00	0.02	0.02	0.00	6.02	0.04	
150R-3, 65	973.23	Talc	v	5.71	0.49	0.00	0.03	0.08	0.00	6.20	0.11	
150R-3, 65	973.23	Talc	v	5.67	0.59	0.00	0.06	0.07	0.00	6.27	0.13	
168R-7, 7	1138.75	Talc	o	5.73	0.40	0.00	0.01	0.01	0.00	6.13	0.02	
173R-4, 105	1183.73	Talc	o	5.77	0.20	0.00	0.00	0.01	0.00	5.99	0.01	
173R-4, 105	1183.73	Talc	o	5.63	0.40	0.00	0.02	0.03	0.00	6.05	0.05	
91R-3, 100	520.98	Serpentine	c	7.55	1.80	0.01	0.03	0.09	0.00	9.36	0.12	
91R-3, 100	520.98	Serpentine	c	7.20	1.99	0.00	0.02	0.05	0.05	9.19	0.11	
91R-3, 100	520.98	Serpentine	c	7.92	0.88	0.00	0.01	0.03	0.00	8.81	0.04	
91R-3, 100	520.98	Serpentine	c	7.86	0.78	0.00	0.01	0.01	0.00	8.64	0.02	
93R-1, 86	532.99	Serpentine	o	7.34	1.72	0.02	0.01	0.01	0.00	9.08	0.02	
177R-5, 50	1207.57	Serpentine	o	7.50	1.22	0.00	0.07	0.02	0.00	8.72	0.10	
173R-4, 105	1183.73	Serpentine	o	7.93	0.77	0.00	0.00	0.01	0.00	8.70	0.01	
103R-2, 139	597.60	Serpentine	o	7.99	0.71	0.01	0.01	0.01	0.00	8.70	0.03	

Table T3. Representative electron microprobe analyses of secondary minerals (feldspars, zeolites, prehnite). (**See table notes.** Continued on next page.)

Core, section, interval (cm)	Piece	Depth (mbsf)	Mineral	Occurrence	SiO_2 (wt%)	TiO_2 (wt%)	Al_2O_3 (wt%)	Cr_2O_3 (wt%)	Fe_2O_3 (wt%)	MnO (wt%)	MgO (wt%)	CaO (wt%)	Na_2O (wt%)	K_2O (wt%)	Total (wt%)	%An	%Ab	%Or
176-735B-																		
90R-3, 97–100	2C	511.76	Plagioclase	i	51.04		31.69		0.39		0.08	14.16	3.30	0.03	100.69	70.1	29.7	0.2
91R-2, 92–97	1E	519.70	Plagioclase	i	50.96		31.27		0.07		0.01	13.67	3.64	0.02	99.64	67.3	32.6	0.1
91R-2, 92–97	1E	519.70	Plagioclase	i	52.31		30.61		0.14		0.02	12.80	4.36	0.01	100.25	61.8	38.2	0.1
91R-2, 92–97	1E	519.70	Plagioclase	i	50.88		31.26		0.11		0.01	13.84	3.65	0.01	99.77	67.6	32.4	0.1
91R-2, 92–97	1E	519.70	Plagioclase	i	51.30		31.06		0.11		0.01	13.27	4.04	0.01	99.81	64.3	35.6	0.1
91R-2, 92–97	1E	519.70	Plagioclase	i	51.34		31.29		0.18		0.00	13.90	3.74	0.02	100.47	67.1	32.8	0.1
91R-2, 92–97	1E	519.70	Plagioclase	i	51.06		31.18		0.18		0.02	14.57	3.48	0.02	100.51	69.7	30.2	0.1
91R-2, 92–97	1E	519.70	Plagioclase	i	50.50		31.10		0.19		0.02	14.53	3.26	0.04	99.64	70.9	28.9	0.2
93R-1, 86–91	5	532.99	Plagioclase	i	54.64		28.78		0.45		0.00	10.81	5.57	0.01	100.26	51.6	48.3	0.1
168R-3, 71–76	3	1133.63	Plagioclase	i	54.05		29.29		0.17		0.02	11.84	5.23	0.02	100.62	55.4	44.5	0.1
168R-3, 71–76	3	1133.63	Plagioclase	i	53.81		29.09		0.21		0.03	11.80	5.30	0.03	100.27	55.0	44.8	0.2
168R-3, 71–76	3	1133.63	Plagioclase	i	54.20		29.07		0.18		0.03	11.48	5.21	0.03	100.20	54.7	45.1	0.2
168R-3, 71–76	3	1133.63	Plagioclase	i	53.35		29.17		0.22		0.02	11.62	5.21	0.02	99.61	55.1	44.8	0.1
173R-4, 105–113	4B	1183.73	Plagioclase	i	54.55		28.48		0.25		0.03	10.80	5.62	0.06	99.79	51.2	48.4	0.3
177R-5, 50–56	2	1207.57	Plagioclase	i	52.65		29.83		0.47		0.00	12.64	4.48	0.02	100.09	60.8	39.1	0.1
177R-5, 50–56	2	1207.57	Plagioclase	i	52.29		29.59		0.37		0.00	12.76	4.65	0.03	99.69	60.1	39.8	0.2
177R-5, 50–56	2	1207.57	Plagioclase	i	53.11		29.77		0.31		0.00	12.60	4.64	0.03	100.46	59.8	40.0	0.2
190R-2, 97–103	2A	1328.23	Plagioclase	i	54.27		28.58		0.38		0.00	11.06	5.29	0.02	99.60	53.5	46.4	0.1
207-5, 53		1474.90	Plagioclase	i	50.76	0.02	28.92		0.47	0.03	0.05	12.60	4.42	0.06	97.32	60.9	38.8	0.4
207-5, 53		1474.90	Plagioclase	i	50.54	0.03	29.01		0.51	0.00	0.04	12.70	4.42	0.03	97.29	61.2	38.6	0.2
207R-6, 1	1	1475.96	Plagioclase	i	53.01		29.90		0.55		0.00	12.57	4.51	0.02	100.56	60.5	39.4	0.1
207R-6, 1	1	1475.96	Plagioclase	i	52.60		29.53		0.50		0.00	12.54	4.41	0.01	99.59	61.0	38.9	0.1
209R-4, 103–111	2B	1493.67	Plagioclase	i	53.08		29.68		0.29		0.00	12.35	4.73	0.02	100.15	58.9	41.0	0.1
209R-4, 103–111	2B	1493.67	Plagioclase	i	52.80		29.56		0.25		0.00	12.48	4.75	0.05	99.89	59.0	40.7	0.3
209R-4, 103–111	2B	1493.67	Plagioclase	i	53.08		29.55		0.26		0.00	12.15	4.68	0.02	99.74	58.8	41.1	0.1
209R-4, 103–111	2B	1493.67	Plagioclase	i	53.16		29.23		0.28		0.00	11.81	5.04	0.03	99.55	56.2	43.6	0.2
209R-4, 103–111	2B	1493.67	Plagioclase	i	53.60		29.37		0.24		0.00	11.97	4.92	0.03	100.13	57.2	42.7	0.2
209R-4, 103–111	2B	1493.67	Plagioclase	i	53.12		29.66		0.40		0.00	12.45	4.66	0.02	100.31	59.5	40.4	0.1
209R-4, 103–111	2B	1493.67	Plagioclase	i	53.26		29.63		0.28		0.00	12.38	4.71	0.04	100.30	59.0	40.8	0.2
181-2, 7		1241.70	Albite	p	68.93	0.05	23.52		0.08	0.00	0.00	0.29	9.50	0.17	102.54	1.7	97.2	1.1
181-2, 7		1241.70	K-feldspar	p	67.93	0.02	21.94		0.06	0.00	0.00	0.02	1.02	11.83	102.83	0.1	11.6	88.3
202-2, 135		1423.90	Albite	v	66.95	0.01	21.01		0.09	0.03	0.00	1.31	10.59	0.02	100.00	6.4	93.5	0.1
202-2, 135		1423.90	Albite	v	64.73	0.01	21.72		0.04	0.03	0.01	2.16	9.94	0.03	98.67	10.7	89.2	0.2
207-5, 53		1474.90	Albite	p	56.42	0.00	24.40		0.07	0.01	0.00	0.04	9.70	0.01	90.66	0.2	99.7	0.1
207-5, 53		1474.90	Albite	p	54.41	0.01	23.78		0.01	0.02	0.00	0.03	10.85	0.01	89.12	0.1	99.8	0.1
207-5, 53		1474.90	Albite	p	57.10	0.00	23.87		0.00	0.01	0.01	0.06	9.05	0.00	90.11	0.4	99.6	0.0
207R-6, 1–7	1	1475.96	K-feldspar	p	66.77		18.43		0.11		0.00	0.04	0.13	14.58	100.06	0.2	1.3	98.4
207R-6, 1–7	1	1475.96	K-feldspar	p	66.20		18.46		0.17		0.00	0.16	0.55	14.47	100.01	0.9	5.4	93.7
207R-6, 1–7	1	1475.96	K-feldspar	p	66.58		18.42		0.03		0.00	0.08	0.35	14.62	100.08	0.4	3.5	96.1
207R-6, 1–7	1	1475.96	K-feldspar	p	65.88		18.55		0.02		0.00	0.11	1.04	14.39	99.99	0.6	9.9	89.6
207R-6, 1–7	1	1475.96	K-feldspar	p	67.35		18.11		0.04		0.00	0.02	0.15	14.48	100.15	0.1	1.6	98.3
207R-6, 1–7	1	1475.96	Albite	p	66.79		20.30		0.09		0.00	1.05	11.09	0.06	99.38	4.9	94.7	0.3
207R-6, 1–7	1	1475.96	Albite	p	67.06		20.25		0.07		0.00	1.11	11.21	0.01	99.71	5.2	94.8	0.1
207R-6, 1–7	1	1475.96	Albite	p	67.10		20.24		0.00		0.00	0.93	11.53	0.02	99.82	4.2	95.6	0.1
207R-6, 1–7	1	1475.96	Albite	p	65.11		21.20		0.14		0.00	2.14	10.87	0.03	99.49	9.8	90.1	0.2
173R-4, 105–113	4B	1183.73	Analcite	p	55.11		22.86		0.00		0.00	0.12	13.79	0.18	92.06			
173R-4, 105–113	4B	1183.73	Analcite	p	54.94		21.19		1.19		3.43	0.35	11.59	0.00	92.69			

Table T3 (continued).

Core, section, interval (cm)	Piece	Depth (mbsf)	Mineral	Occurrence	SiO_2 (wt%)	TiO_2 (wt%)	Al_2O_3 (wt%)	Cr_2O_3 (wt%)	Fe_2O_3 (wt%)	MnO (wt%)	MgO (wt%)	CaO (wt%)	Na_2O (wt%)	K_2O (wt%)	Total (wt%)	%An	%Ab	%Or
177R-5, 50–56	2	1207.57	Analcite	p	54.15		23.53		1.18		0.24	1.79	12.16	0.00	93.05			
177R-5, 50–56	2	1207.57	Analcite	p	53.95		23.91		0.09		0.00	0.61	13.23	0.00	91.79			
177R-5, 50–56	2	1207.57	Analcite	p	54.61		23.75		0.06		0.00	1.55	12.39	0.00	92.36			
177R-5, 50–56	2	1207.57	Analcite	p	54.92		23.72		0.07		0.00	1.42	12.41	0.00	92.54			
172-7, 132		1178.10	Natrolite	v	52.81	0.00	28.93		0.12	0.00	0.02	0.18	11.00	0.00	93.07			
172-7, 132		1178.10	Natrolite	v	49.31	0.04	28.37		0.03	0.00	0.02	1.20	9.52	0.01	88.50			
180R-4, 109–119	9C	1235.92	Analcite	v	54.87		21.71		0.19		1.75	0.21	12.23	0.00	90.96			
180R-4, 109–119	9C	1235.92	Analcite	v	57.25		23.88		0.27		0.59	0.27	11.50	0.00	93.76			
180R-4, 109–119	9C	1235.92	Analcite	v	56.66		23.55		0.12		0.04	0.15	12.73	0.00	93.25			
180R-4, 109–119	9C	1235.92	Analcite	v	54.86		22.15		0.55		2.39	0.24	12.48	0.00	92.67			
180R-4, 109–119	9C	1235.92	Analcite	v	55.81		23.61		0.07		0.00	0.11	13.18	0.00	92.78			
190R-2, 97–103	2A	1328.23	Natrolite	v	48.45		23.66		0.67		4.40	2.40	11.06	0.00	90.64			
190R-2, 97–103	2A	1328.23	Natrolite	v	48.92		26.32		0.17		0.80	1.28	13.72	0.00	91.21			
190R-2, 97–103	2A	1328.23	Natrolite	v	48.31		25.16		0.48		2.49	2.11	12.29	0.00	90.84			
190R-2, 97–103	2A	1328.23	Natrolite	v	48.59		24.34		0.85		4.21	2.97	10.16	0.00	91.12			
190R-2, 97–103	2A	1328.23	Natrolite	v	48.54		25.73		0.30		1.29	0.88	14.08	0.00	90.82			
190R-2, 97–103	2A	1328.23	Natrolite	p	48.73		26.88		0.30		0.41	1.11	14.39	0.00	91.82			
197-2, 34		1385.10	Thomsonite	v	42.04	0.01	29.12		1.41	0.02	2.29	10.28	1.90	0.01	87.08			
209R-4, 103–111	2B	1493.67	Thomsonite	p	39.09		29.40		0.00		0.00	12.05	4.61	0.00	85.15			
209R-4, 103–111	2B	1493.67	Thomsonite	p	39.25		29.75		0.00		0.00	12.04	4.63	0.00	85.67			
209R-4, 103–111	2B	1493.67	Thomsonite	p	40.73		29.11		0.05		0.00	11.46	4.94	0.00	86.29			
209R-4, 103–111	2B	1493.67	Thomsonite	p	40.99		28.98		0.00		0.00	11.54	4.98	0.00	86.49			
209R-4, 103–111	2B	1493.67	Thomsonite	p	40.81		28.77		0.00		0.00	11.29	4.98	0.00	85.85			
209R-4, 103–111	2B	1493.67	Thomsonite	p	40.08		28.82		0.04		0.00	11.63	4.58	0.00	85.15			
91R-2, 92–97	1E	519.695	Prehnite	p	40.76	0.12	23.13	0.00	4.01	0.00	5.21	20.36	0.02	0.22	93.85			
202-2, 135		1423.90	Prehnite	v	42.61	0.02	24.31		0.16	0.09	0.00	26.33	0.01	0.00	93.51			
202-2, 135		1423.90	Prehnite	v	42.04	0.00	24.10		0.15	0.06	0.00	26.77	0.00	0.00	93.12			
202-2, 135		1423.90	Prehnite	p	41.45	0.09	23.52		0.85	0.10	0.00	26.15	0.03	0.00	92.19			
209R-4, 103–111	2B	1493.67	Prehnite	v	42.53		23.08		1.60		1.50	24.74	0.13	0.00	93.58			
209R-4, 103–111	2B	1493.67	Prehnite	v	42.35		22.91		1.81		2.69	23.84	0.12	0.00	93.72			
209R-4, 103–111	2B	1493.67	Prehnite	p	43.32		23.28		0.10		0.00	25.80	0.25	0.00	92.75			
209R-4, 103–111	2B	1493.67	Prehnite	p	43.57		23.46		0.20		0.00	26.25	0.18	0.00	93.66			

Notes: I = igneous, p = plagioclase, v = vein. An = anthorite, Ab = albite, Or = orthoclase.