Analysis of core saw cuttings[1]

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Chapter contents

Introduction

During Integrated Ocean Drilling Program (IODP) Expedition 345, a new strategy for collecting, processing, and analyzing core saw cuttings was employed to obtain a representative sample of coarse-grained plutonic rock encountered at Hess Deep (see **"Collection of core saw cuttings"** in the "Methods" chapter [Gillis et al., 2014]). In the core recovered during Expedition 345, gabbroic rock with grain sizes >0.5 cm is common, with oikocrysts as large as 5 cm, and only very large samples can produce an average composition. In cases where drill cores are involved, this grain size requires an exceptionally long sample that would otherwise destroy much of the core. Point samples are few in number, preferentially taken on fine-grained homogeneous and plentiful lithologies in the core and generally avoiding altered, delicate, and "interesting" intervals with minerals, textures, and structures of interest for microscopic study, introducing a variety of sampling biases. To avoid this problem, we collected core cuttings from the rock saw.

Saw cuttings samples

Fifty-five samples were collected from Holes U1415G–U1415J, U1415N, and U1415P, including three samples obtained from single, long lengths of core that were cut separately on the core-splitting "super saw." Three different grain sizes were collected from many samples:

1. An unsorted "mud sample,"
2. A >10 µm sample from the filter, and
3. A <10 µm clay sample obtained by centrifuging the supernatant (see **"Collection of core saw cuttings"** in the "Methods" chapter [Gillis et al., 2014]).

However, in some samples no material remained on the 10 µm sieve, and no material of this size was collected. All but the clay-sized samples were weighed and packaged in sealed plastic bags and entered into the IODP archive. The length of cut core was measured, but the lengths were adjusted to compensate for the dimensions of samples with less than the full 5.5 cm width of the core.

From this work, 4460 g of bulk mud as well as a >10 µm sample was recovered from 4050 cm of the cut core. The weight of the <10 µm fraction was not measured on the ship. The relationship between the length of core cut (in centimeters) and grams of cut-

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[2]**Expedition 345 Scientists' addresses.**

tings recovered is shown in Figure **F1.** The linear relationship shows a systematic recovery rate of >1 g recovered per centimeter of core cut. This apparent rate will increase when the clay-sized fraction is included in the calculation. The significance of this linearity is that all samples show a uniform yield, such that the results of X-ray diffraction (XRD) and chemical analyses of all samples may be reasonably compared.

Wash water from the cutting of each sample was milky, indicating that sawing created clay-sized (<2 µm) particles. To test whether the collection of this material was necessary, the three size fractions from Section 345-U1415J-8R-1 were each analyzed by XRD; the results are compared in Figure **F2.** The diagram shows that the green trace of the clay-sized suspension systematically shows taller peaks for phyllosilicates and lower peaks for plagioclase and pyroxene than either the bulk sample or the >10 µm sample. Thus, the sawing process fractionates minerals by grain size. Preliminary calculations show that this clay fraction may contribute more than one-third of the total mass of the sample. The clay-sized (<2 µm) fraction is therefore necessary to obtain a representative analysis.

Reference

Gillis, K.M., Snow, J.E., Klaus, A., Guerin, G., Abe, N., Akizawa, N., Ceuleneer, G., Cheadle, M.J., Adrião, Á., Faak, K., Falloon, T.J., Friedman, S.A., Godard, M.M., Harigane, Y., Horst, A.J., Hoshide, T., Ildefonse, B., Jean, M.M., John, B.E., Koepke, J.H., Machi, S., Maeda, J., Marks, N.E., McCaig, A.M., Meyer, R., Morris, A., Nozaka, T., Python, M., Saha, A., and Wintsch, R.P., 2014e. Methods. *In* Gillis, K.M., Snow, J.E., Klaus, A., and the Expedition 345 Scientists, *Proc. IODP,* 345: College Station, TX (Integrated Ocean Drilling Program). **doi:10.2204/iodp.proc.345.102.2014**

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Figure F1. Weights of saw cuttings recovered from Site U1415 samples compared to the linear length of core cut to produce these cuttings. The linear trend shows a uniform process of collection with a recovery rate of ~1.1 g/cm.

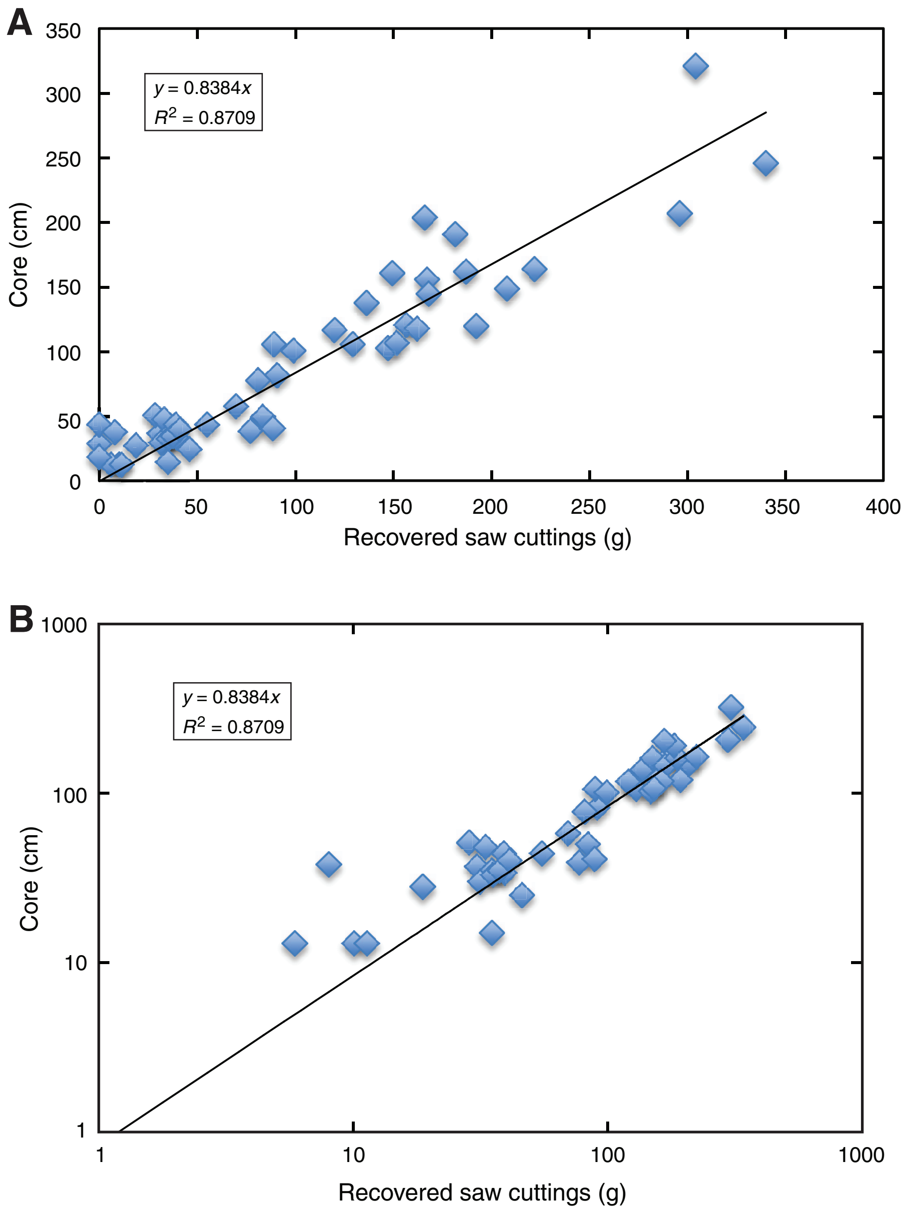

Figure F2. X-ray diffraction spectra of three grain sizes of cuttings from Section 345-U1415J-8R-1. The data show that phyllosilicates (green line) are preferentially fractionated into the clay-size sample relative to the coarser samples. Chl = chlorite, Tc = talc, Liz = lizardite, Am = amphibole, Pl = plagioclase, Cpx = clinopyroxene.