APPENDIX II. STRUCTURAL GEOLOGY THIN-SECTION DESCRIPTION

The following six thin-sections were made to characterize the two main types of structures recognized at Site 808, faults and shear bands. In total, four faults and two shear bands were sampled; one of the faults (Sample 131-808C-8R-1, 70–71 cm) also contained an unusually thick zone of black material. See the structural geology section of the Site 808 chapter (this volume) for a more complete discussion of these structures.

Sample 131-808B-17X-2, 125–127 cm (Fault)

This thin section is composed dominantly of homogeneous claystone with very few tectonic structures. Bedding is well defined and consists of both fine-grained phyllosilicates and discontinuous stringers or layers of organic material.

The only tectonic structure present in this thin-section is a fault zone that crosses the entire length of the thin-section at a low angle to bedding (<10°). The zone is less than a few tenths of a millimeter thick, very irregular, and changes thickness along its length. This width is much less than that typical of shear bands. Within the zone the phyllosilicates are reoriented compared to those outside the zone and appear to be oriented with their long axis at a low angle to the shear zone boundaries.

Sample 131-808B-17X-2, 55–56 cm (Fault)

This section is also a homogeneous claystone with only one tectonic structure–a very narrow fault zone. Bedding is well defined by the preferred orientation of phyllosilicates and thin traces of organic matter. The fault zone cuts bedding at a moderate angle (approximately 45°) and reorients the phyllosilicates that define bedding. Within the zone the phyllosilicates can occur at a variety of angles relative to the fault zone boundaries. However, their orientation is always consistent with reverse displacements on the fault zone. Reverse motion is also indicated by slightly folded layers of organic matter.

Sample 131-808B-17X-4, 63–64 cm (Several Faults)

This thin-section reveals a slightly more coarse-grained claystone than is present in the two sections from Section 131-808B-17X-2. Small grains of quartz and/or feldspar are dispersed throughout this section and bedding is much more poorly defined. However, the few faults present appear to be nearly parallel to bedding. The thin-section is also generally too thick for detailed observations to be made.

The few tectonic structures present, however, are faults, clearly defined by the preferred orientation of phyllosilicates. The faults are very narrow (<0.1 mm) and irregular along their length. Within the fault zones, the phyllosilicates appear to be generally parallel to the boundaries of the zones.

Sample 131-808B-24X-3, 98–100 cm (Shear Band)

This thin-section is also composed of a fine-grained clay with bedding defined by the preferred orientation of phyllosilicates and relatively short and irregular stringers of organic matter. Bedding is oblique to the two main tectonic structures by about 45°.

The two structures present in this section are defined by a subtle change in texture and color of the matrix material. This change is best observed in plane light at low magnification and was particularly evident in this section because of a red die used in polishing the section. The die was commonly present in the matrix but not within the shear bands, which may reflect a difference in initial porosity between the shear band and the matrix. The phyllosilicate fabric within the shear bands does not appear to be much different than the fabric outside the bands. That is, the development of the shear bands has apparently not significantly reoriented the bedding-parallel phyllosilicate fabric. In fact, in some areas, layers of slightly coarser grained sediments can be traced across the shear band and they are only slightly deflected, if at all. Overall, the displacement associated with the formation of the shear bands in this sample appears to be relatively small.

Sample 131-808C-8R-1, 70–71 cm (Black Fault from Frontal Thrust)

This thin-section is composed of a fine-grained claystone that is highly deformed relative to the other samples. The dominant structure is a wide (1–2 mm) fault zone that is black in hand sample. In thin-section this zone is composed of phyllosilicates that display a very well-developed preferred orientation. The boundaries of this zone are very sharp and, in plane light, are marked by a slight change in color. In detail, the phyllosilicates appear to form two fabrics. The dominant set (based on overall alignment of phyllosilicates) dips gently in the direction of shear inferred for the zone as a whole, whereas the second, less dominant set dips at low angle in the opposite direction. There is no obvious indication in thin-section as to why this zone appears so dark in hand sample.

The structures in the rest of the thin-section are relatively narrow fault zones that have displacement directions consistent with that inferred for the larger zone. These smaller fault zones are also defined by the reorientation of phyllosilicates.

Sample 131-808C-8R-2, 19–20 cm (Shear Band from the Frontal Thrust)

This sample is also composed of a fine-grained claystone that is highly deformed. The dominant structure is a relatively wide band that is defined in part by a very well-developed phyllosilicate fabric that is oblique to the phyllosilicate fabric outside the band (assumed to be bedding). Like Sample 131-808C-8R-1, 70–71 cm, the phyllosilicate fabric inside the band appears to be composed of two subfabrics with one dipping in the direction of shear and the second dipping in the opposite direction. Again, the fabric dipping in the direction of shear is more conspicuous, based on the intensity of the phyllosilicate alignment.

The structures in the remaining part of the thin-section are relatively broad shear bands that are defined by a slight to moderate reorientation of the phyllosilicate fabric. These relatively broad bands are kink-like in their geometry and appear to record relatively small amounts of displacements.

Overall, the broad shear band in this section is very similar in geometry and fabric development to the wide fault zone in Sample 131-808C-8R-1, 70–71 cm, which is surprising because these samples were collected because of their different hand sample appearances. On the other hand, the other shear bands in Sample 131-808-8R-2, 19–20 cm, are clearly different from any structure observed in Sample 131-808C-8R-1, 70–71 cm. Apparently the faults and shear bands represent end-members of a spectrum of structures that are present at Site 808.