DR2004155

Appendix DR1

Examples of data from shotpoint 26 along 2-D lines are shown in Figure DR-1. Predicted arrival times from the model are overlain on the actual data, which is reduced at 6 km/s. The southern end of the inline shot has a much lower signal-to-noise ratio than other regions of the data, which is true for all shots.

Synthetic seismic models are included in Figures DR-2 through DR-4. The first model, in Figure DR-2, is a simplification of our velocity model of the central region, showing the anomalies below the magmatic segments of Koka, Boseti, and Fantale-Dofan, and the high-velocity anomaly off-axis NW of the Koka segment. The goal of this inversion is to demonstrate that if these features are present, they can be successfully recovered by the inversion. This model was input into the same code using the same sources and receivers as in the actual inversion. As the recovered model indicates, the features are well-recovered and can be successfully imaged.

A non-segmented mafic intrusion is shown in Figure DR-3. This synthetic model was created to test whether the segmentation visible in the actual model (Figure 2) is real or an artifact of poor ray coverage. The intrusion covers the magmatic segments of Boseti and Fantale-Dofan. The recovered model shows that the entire intrusion is recovered with no apparent segmentation, supporting the interpretation that the segmentation is real and corresponds to the segmentation of magmatic segments at the surface.

The final synthetic model is a cross-section along line A-A' (Figure 1). The purpose of the model is to show the amount of lateral smearing of the high-velocity body as well as to test whether 30% diking should be visible in the output model. As can be seen, the main high-Vp body is recovered with only slight lateral smearing, and the dikes are manifested as a continuation of the main anomaly to shallower depths. This would indicate that diking of 30% should be visible in the actual model if present in the magmatic segments, although the diking here is distributed as 6.8 km/s dikes 2-km-wide (due to the limitations imposed by our cell size).

Another method to test whether 30% diking should be evident in our model is to calculate what the bulk velocity effect would be if the dikes were widely distributed in thin sheets throughout the model. Several kilometers beneath the rift axis, the velocity in the recovered model is ~3.8 km/s (Figure 3a). If this is due to a combination of sediments and 30% intruded dikes at 6.8 km/s, one can calculate what sediment velocity is required for a bulk velocity of 3.8 km/s. The calculations result in a required velocity of 2.35 km/s for the sediments if 30% diking is present, which is unlikely. If only 20% diking is present, the required sediment velocity is 2.8 km/s, a more reasonable value. Based on both the synthetics and these rough calculations, we estimate the upper bound on diking throughout the magmatic segments as ~30%.

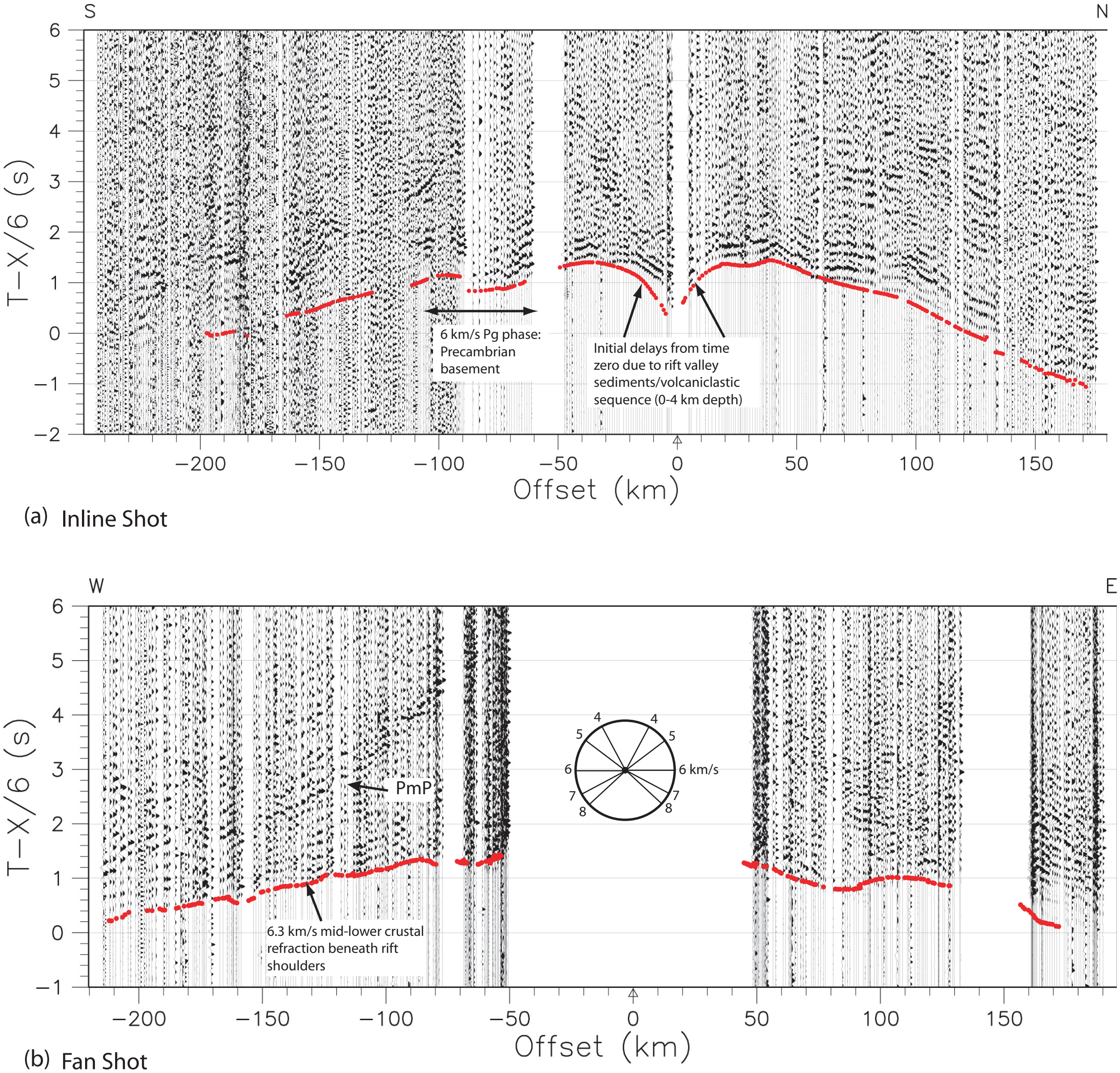

Figure DR1: Data reduced at 6 km/s from shotpoint 26 into instruments on (a) the along-axis line and (b) the across-axis line. Traces are filtered using a bandpass filter from 2-12 Hz. Note low signal-to-noise ratio on southern end of along-axis line. Predicted travel-times from final model are overlain on traces for an estimate of fit between model and data. RMS deviation of picks for model is ___ ms in (a) and ___ ms in (b). Although short-wavelength features are smoothed slightly, longer wavelength features are very well modeled.

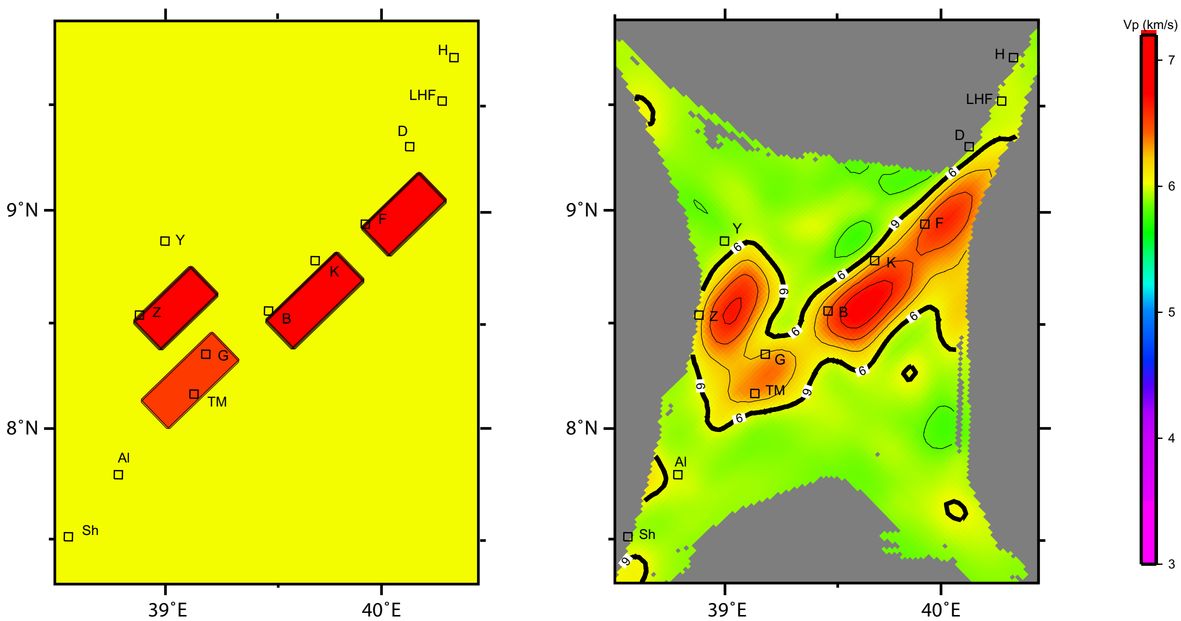

Figure DR2: (a) Synthetic seismic model at a depth of 10 km below the rift floor. Model was input into code used in actual inversion with same sources and receivers to test the ability of the model to recover the interpreted anomalies. Red bodies with high Vp represent mafic intrusions, background velocity is near 6.0 km/s. Locations of volcanoes are shown as diamonds. (b) Output from inversion program. Bodies representing mafic intrusions are well-recovered by the model and segmentation is preserved.

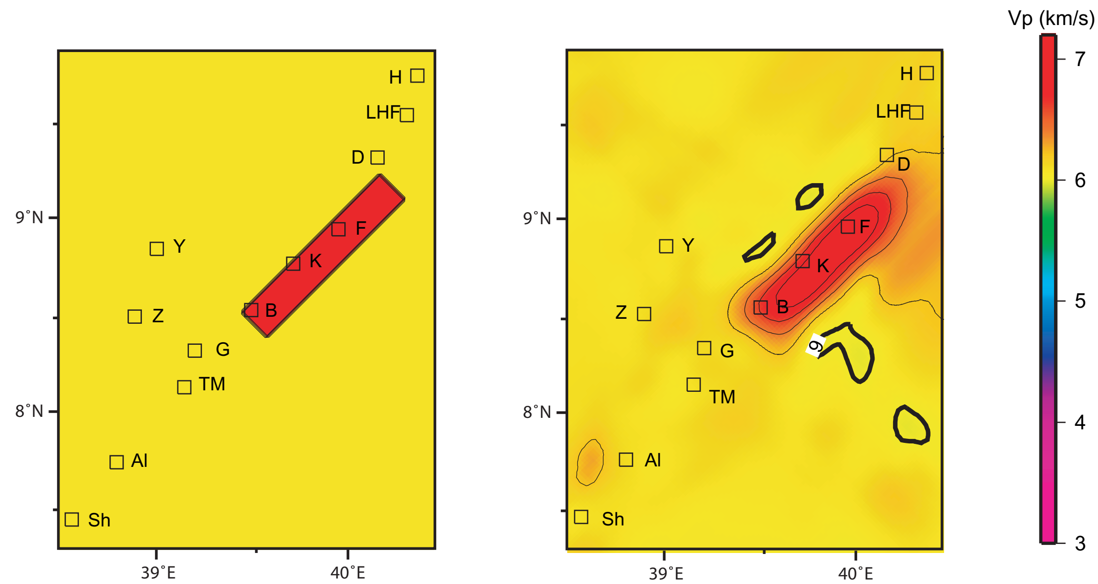

Figure DR3: (a) Synthetic seismic model at a depth of 10 km below the rift floor. Red body represents high-Vp mafic intrusions between the Boseti and Fantale-Dofan segments, but without segmentation. Goal of this model is to test whether ray coverage deficiencies will introduce artificial segmentation into final recovered model. Model was input into code used in actual inversion with same sources and receivers to test the ability of the model to recover the interpreted anomalies. Locations of volcanoes are shown as diamonds. (b) Output from inversion program. Body representing mafic intrusions is well-recovered by the model and no segmentation is introduced.

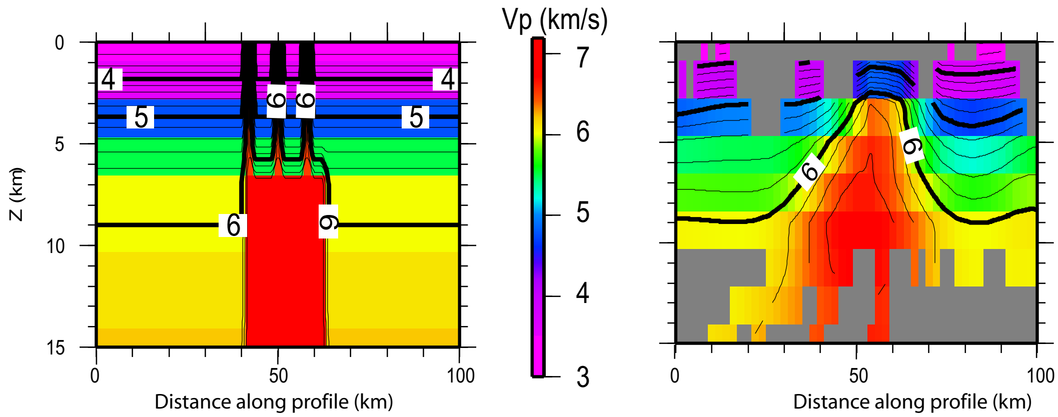

Figure DR4: (a) Synthetic seismic model at a depth of 10 km below the rift floor. This model shows one of the mafic intrusions in cross-section at the location of section A-A' (Figure 1), with 30% diking above the main intrusion. The goal of this synthetic is two-fold, first to determine if the main intrusion is recovered, and second, to determine if 30% diking would be visible in the recovered model. Model was input into code used in actual inversion with same sources and receivers. (b) Output from inversion program. Body representing mafic intrusion is well-recovered by the model and diking causes high-velocities to extend to shallow depths. If diking was distributed in this manner across the magmatic segments, it would be visible in the recovered model. Also see text of supplementary material for discussion of bulk velocity increases resulting from thin, widely-dispersed dikes.