Mapping Igneous Intrusive and Extrusive from 3D Seismic in Chicontepec Basin, Mexico

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Seismic Modelling

30 Sources 196 receivers 50Hz and 100Hz 3 m and 2 m gridding

Igneous intrusive 3000 m/s Reflection

6600 m/s Multiple from the same reflector 3000 m/s

3500 m/s Curvature 4500 m/s

Figure 10. (a) Location of two vertical seismic lines crossing beneath the largest volcanic cone. (b) The two seismic lines shown in (a), along with the coherence time slice at t=1.335 s. Orange arrows indicate volcanic sills. Green arrows indicate mounds that we interpret to be volcanoclastic buildups.

Figure 14. (a) Amplitude image at t= 1335 ms. (b) Blended image of the Coherence and Amplitude attribute at t= 1335ms. (c) Variances attribute at t= 1335ms. (d) Coherence attribute at t= 1335 ms. (e) Blended image of the Most Positive Curvature, Most Negative Curvature, and Coherence attribute at t= 1335ms. (f) Blended image ofthe RMS and Coherence attribute at t= 1335ms.

Head $P$ wave

Although the exploration objective in the Amatitlán survey area is primarily to map the Chicontepec formation, this objective is handicapped by the presence of shallow volcanics that disrupt the deeper signal. Through careful statics, trace balancing, and velocity analysis, many of these disruptions can be attenuated, particularly those that give rise to 'shadows' beneath the high impedance volcanics. Sills that are intruded parallel to stratigraphic horizons cause few problems with the deeper seismic. However, sills that cut upward from horizon to horizon as the Chincontepec formation is composed of low-permeability turbidites and sheet sands that are encased in a shale matrix and cut by incoherent mass transport complexes.

Head $S$ wave

The seismic data associated with the overlying volcanics. At present, our objective is to map these 'poor data quality' zones and thereby risk-weight our texture-based interpretation of the Chicontepec formation. If yet more reprocessing is considered some time in the future, these shallow high velocity zones can help constrain our velocity analysis. Our next step is to evaluate the potential correlation of permeability measured in wells to proximity to volcanics.

Figure 11. a) Shaded relief map for the extrusive volcanic. b) Shaded relief map for one of the intrusive volcanic from a vertical seismic section.

Figure 13. (a) Seismic Model setup including igneous intrusive (Purple) and extrusive (Dark Blue) with alternated shale and carbonate. Bilobed Model (b) Model response focus on the igneous body response. (d) Ray Trace model focus on the lower igneous intrusive geobody.

Multi Attribute Analysis

(a) Coherence

(b) Coherence

Figure 15. (a) Blended image of all of the volcanic sills in the survey. (b) Blended image of the structure map in (a) with the coherence image in (c) superimposed. Note the correlation between the location of some of the volcanic sills and the incoherent mechanism time slice in the section.