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3-D Seismic Imaging and Morpho-tectonical Interpretation of Saucer-like Dykes of the Tarim Flood Basalt Province, NW China

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The detailed structures of the plumbing system of the early Permian Tarim flood basalt were investigated by 3-D seismic imaging. The images show that the Tarim flood basalt mainly erupted from central volcanoes distributed along major faults. Normal sheet-like dykes and sills were rare. Whereas at several locations saucer-like dykes were imaged at depths of ~400-1400 m below the lava surface. The propagation of the saucer-like dykes cannot be explained by the neutral buoyancy theory but should be related to the changing of the stress field during the magma ascending and eruption. Hydraulic fracturing of the hanging wall by overpressure of the magma conduit may be an explanation. However, no central plug-like feeding intrusions have been observed around the saucer-like dykes. Another explanation is that the density of the magma changed very fast during ascending, so that the minimum principal stress was changed from horizontal to vertical. This mechanism requires a gas-driven ascending and fast degassing during decompression. Reaction between the magma and carbonate wall rock may be able to provide enough CO_2 into the magma.

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