Stratigraphy, Structure, and Origin; A Geophysical Survey of the Mendeleev Ridge

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The Mendeleev Ridge is a broad, aseismic ridge that extends from the Siberian Shelf into the central Arctic Ocean. While it is continuous with the Alpha Ridge and is inferred to be an oceanic plateau, it may have had a distinct and separate history. The origin of the Mendeleev ridge has only rarely been visited and, as a result, understanding the history of this region has largely been based on the presumption of a common origin for both features. In late summer 2005, a geophysical survey was conducted from USCGC Healy over the Mendeleev Ridge as part of a trans-arctic crossing. During this survey ~730 km of seismic reflection data was recovered over the ridge along with co-registered gravity and bathymetry data and seismic refraction profiles. The seismic source was two 250 cu in G-guns. The streamer length was limited by ice conditions to 300 meters. Wear and tear caused by towing the streamer through the ice pack eliminated hydrophones, so the number of active channels ranged from 24 to as few as 11. The seismic reflection data requires significant trace editing to eliminate random electrical noise and frequency-wave number filtering to eliminate low velocity noise caused by the streamer traveling through heavy ice. After trace editing the data are stacked and migrated with constant water velocity. Stacking velocities are used as input into initial ray tracing models. Derived boundary velocities from ray tracing models will be reapplied to the migration of reflection data and are converted through empirical relationships into densities, and used as input into gravity models. Brute stacked reflection images of the Mendeleev Ridge reveal pervasive extensional faulting of the basement and lower sediment layers, and a continuous, undeformed pelagic sediment layer mantling the ridge, indicative of recent tectonic inactivity. The age of the unconformity underlying this layer should date the end of significant deformation of the Alpha and Mendeleev Ridges. Consistency of modeled seismic velocities from the upper basement will provide some insight into the nature of the crustal material. Upper basement velocities estimated from the sonobuoy data range from 3.7-5.0 km/s, suggestive of a heterogeneous upper crust. Initial gravity models suggest that much of the amplitude variation over the Mendeleev Ridge is accommodated by invoking a single, continuous density layer for the crust.

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