Geophysical Research Abstracts
Vol. 19, EGU2017-17741-1, 2017
EGU General Assembly 2017

Continental Affinities of the Alpha Ridge

H. Ruth Jackson (1), Qingmou Li (1), John Shimeld (1), and Deping Chian (2)

(1) Geological Survey of Canada Atlantic, 1 Challenger Dr., P.O. Box 1006, Dartmouth, N.S. B2Y 4A2 Canada, (2) Chian Consulting, 6238 Regina Terrane, Halifax N.S., B3H 1N5 Canada

Identifying the crustal attributes of the Alpha Ridge (AR) part of the High Arctic Large Igneous Province and tracing the spreading centre across the Amerasia Basin plays a key role in understanding the opening history of the Arctic Ocean. In this approach, we report the evidence for a continental influence on the development of the AR and reduced ocean crust in the Amerasia Basin. These points are inferred from a documented continental sedimentation source in the Amerasia Basin and calculated diagnostic compressional and shear refraction waves, and from the tracing of the distinct spreading centre using the potential field data.

(1) The circum-Arctic geology of the small polar ocean provides compelling evidence of a long-lived continental landmass north of the Sverdrup Basin in the Canadian Arctic Islands and north of the Barents Sea continental margin. Based on sediment distribution patterns in the Sverdrup Basin a continental source is required from the Triassic to mid Jurassic. In addition, an extensive continental sediment source to the north of the Barents Sea is required until the Barremian.

(2) Offshore data suggest a portion of continental crust in the Alpha and Mendeleev ridges including measured shear wave velocities, similarity of compressional wave velocities with large igneous province with continental fragments and magnetic patterns. Ocean bottom seismometers recorded shear waves velocities that are sensitive to the quartz content of rocks across the Chukchi Borderland and the Mendeleev Ridge that are diagnostic of both an upper and lower continental crust. On the Nautilus Spur of the Alpha Ridge expendable sonobuoys recorded clear converted shear waves also consistent with continental crust. The magnetic patterns (amplitude, frequency, and textures) on the Northwind Ridge and the Nautilus Spur also have similarities. In fact only limited portions of the deepest water portions of the Canada Basin and the Makarov Basin have typical oceanic layer 2 and 3 crustal velocities and lineated magnetic anomalies.

(3) The gravity and magnetic anomalies associated with the spreading centre in the Canada Basin unveiled by multifractal singularity analysis of the potential field data can now be traced as far as the Lomonosov Ridge. In addition, linear magnetic features cutting across the spreading centres are identified as transform faults.

The combination of the detected continental attributes of AR, the quantification of transform faults, and the outlined reduced extent of oceanic crust in the Amerasia Basin provide new insights into the opening history of the basin.