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Paleomagnetism of the Mesozoic Asik Mountain Mafic Complex in Northern Alaska: Implications for the Tectonic History of the Arctic Composite Terrane

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Abstract

At least three mutually exclusive hypotheses exist for the origin of the Arctic composite terrane and its Mesozoic location relative to the stable craton of North America. The most widely accepted hypothesis calls for counterclockwise rotation of the Arctic composite terrane as it rifted from the Arctic Archipelago. A second hypothesis calls for no relative movement, and a third places the Arctic composite terrane on the Kula plate as a part of a separate ribbon-shaped microcontinent. All three hypotheses predict unique positions for the Arctic composite terrane with respect to rotation and translation since the middle of the Mesozoic. Paleomagnetic and susceptibility studies were conducted on rocks from 15 sites in the ~160 Ma (K-Ar cooling age) Asik Mountain mafic to ultramafic complex in the western part of the Arctic composite terrane. Coherent data from 11 sites yielded a direction of dec = 255.1°, inc = 82.1°, κ = 19.3, α_{95} = 9.6°, α_{63} = 5.6°. Contact and fold tests were not possible but the direction differs distinctly from the modern magnetic direction. The anisotropy of magnetic susceptibility revealed a well-developed oblate fabric of variable orientation. The orientation of the fabric was not related to the regional stress regime, so we conclude that the rocks were not deformed and metamorphosed during thrusting, and thus the magnetic remanence direction obtained is most likely primary. The direction yields a pole position at long = 166.8°E, lat = 59.8°N, A_{95} = 18.4°, A_{63} = 10.7° that is discordant to the expected 160 Ma reference direction for North America. Counterclockwise rotation of the Arctic composite terrane would yield a perfect fit to the 160 Ma reference pole with an allowance for up to 5° of northward translation. This result, combined with previous paleomagnetic data, makes a convincing argument that the Arctic composite terrane has not remained fixed in its current orientation with respect to North America. However, the data are not sufficient to differentiate between the two hypotheses that suggest movement of the Arctic composite terrane relative to North America.

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