An Integrated Geophysical Investigation of Greenland's Tectonic History

DISSERTATION

Presented in Partial Fulfillment of the Requirements for

the Degree Doctor of Philosophy in the

Graduate School of The Ohio State University

By

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The Ohio State University

1999

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ABSTRACT

A new model for the crustal evolution of the Labrador Sea region of southwestern Greenland (58.7 - 61.9°N and 48 - 53°W) was developed from gravity-derived Moho estimates and lithologic and geologic features interpreted from correlative geopotential anomalies, and recent seismic surveys [Chian and Louden, 1994; Chian et al., 1995a, Chian et al., 1995b; Chalmers and Laursen, 1995]. Previous kinematic models [Srivastava, 1978; Srivastava and Tapscott, 1986; Roest and Srivastava, 1989] suggested that the opening of the Labrador Sea caused a counterclockwise rotation of Greenland from ca. 92 to 36 Ma as a part of the opening of the North Atlantic Ocean. These models were based on interpretation of a 150 km wide zone of crust off of the coasts of Greenland and Labrador as oceanic crust with continuous magnetic isochrons through anomaly 33. The structural implications of the gravity-derived Moho and crustal density models challenge this interpretation. Instead, this region is interpreted a combination of rifted-continental and transitional crust. The correlation analysis of free-air gravity and magnetic anomalies determined that rocks within this 150 km zone were more characteristic of rifted-continental or transitional crust, and this was further supported by the results of seismic surveys [Chian and Louden, 1994; Chian et al., 1995a; 1995b; Chalmers and Laursen, 1995]. The linear magnetic anomalies interpreted as isochrons 31 and 33 by Roest and Srivastava [1995] were interpreted as serpentinization along the crustal rupture and delamination surfaces or

along the base of regional-scale half-grabens. The revised model postulates that the rotational opening of the Canada Basin from 135 to 115 Ma induced a counterclockwise rotation of Greenland, which extended and thinned the Archean crust between Greenland and Labrador. This weakened crust was thus well disposed to rifting when the North Atlantic rift system propagated northward into the region at about 90 Ma. Slow extension rates and an insufficient supply of magma delayed the initiation of oceanic spreading until about 63 Ma when Greenland began to separate from North America and move with Europe.

To Lauren for being loving, supportive, and understanding especially when I was away from home working on all those long, cold, and lonely nights.

ACKNOWLEDGMENTS

Foremost, I thank Dr. Ralph von Frese for his brilliant tutelage, financial support, and academic advice over the years. I also thank Dr. Ken Jezek who has been another source of academic wisdom and support. I thank Drs. Hal Noltimier and Chris Jekeli for their advice and comment during my research and the reviews of this manuscript.

I thank my parents and family for their support and understanding throughout the long process of obtaining both my graduate degrees. I also thank Lauren for taking care of the details in life so that I could stay focused on my research.

Thanks also go to Drs. Jeong Woo "Jay" Kim, Francois Baumgartner, Dru Smith, Bea Csathó, Li Tan, and countless others who have assisted me greatly in my efforts. I also appreciated the camaraderie, advice, and assistance I received from Brent Curtiss, Hyung Rae Kim, Jens Munk, Laramie Potts, Tim Leftwich, and others in the departmental computer labs.

This work has been partially supported by grants from NASA's Polar Oceans and Ice Sheets Program and the Geodynamics Branch at NASA's Goddard Space Flight Center, as well as by the Byrd Polar Research Center, the Department of Geological Sciences, the Center for Mapping, and the Ohio State Supercomputer Center. I also would like to thank the European Space Agency for providing access to radar altimeter data for this study and the National Imagery and Mapping Agency for providing access to free-air gravity anomalies in the Greenland area.

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PUBLICATIONS

Roman, D.R., B. Csatho, K.C. Jezek, W.B. Krabill and K. Kuivinen, Gravity Values Measured on the Greenland Ice Sheet, BPRC Technical Report 98-01, Byrd Polar Research Center, The Ohio State University, Columbus, Ohio, pp. 39, 1998.

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FIELDS OF STUDY

Major Field: Geological Sciences

Studies in:

Potential Field Geophysics	Drs. von Frese & Noltimier
Gravimetric Geodesy, Spectral Geodesy	Drs. Rapp & Jekeli
Geomathematics, Geostatistics	Dr. von Frese
Remote Sensing, GPS	Drs. Jezek & Goad
Geodynamics, Rheology	Drs. Noltimier & Whillans

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