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NEW DATA SUPPORT NEW HYPOTHESES ABOUT ARCTIC OCEAN TECTONICS; PLANNING EXPEDITIONS FOR THE NEXT DECADE.

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In the last two decades, much has been learned about the Arctic Ocean. This knowledge has accumulated to the point where the basin description, the form of its primary features and the potential fields data that characterize the structure and composition of these features, is nearly on a par with other ocean basins. These data are defective in various ways, owing to the difficulty of working in the presence of sea ice, but are sufficient to frame hypotheses about origin and history of the ocean, supporting hypothesis-driven research.

Data acquisition in the basin has focused on the bathymetric features, in particular, the ridges that subdivide the Arctic Ocean into its various sub-basins. The Lomonosov Ridge separates the Eurasia and Amerasia Basins, the first formed in during the Cenozoic by the propagation of the mid-Atlantic Ridge across the edge of the Barents Shelf. While the kinematic history of this basin is well understood from the seafloor magnetic anomalies, the processes of ultra-slow spreading are not well understood.

Gakkel Ridge, the slowest spreading ridge in the world ocean, is curious due to the complete lack of transform faults. The ridge axis is continuous and sinuous. While the ridge does not appear to be mechanically segmented, dramatic magmatic segmentation has been observed. In the central basin, the seafloor is composed of altered gabbro and peridotite, adjacent to this zone is more typical basaltic crust. Understanding this segmentation, particularly towards the Laptev Shelf, where the lowest spreading rates are observed, is critical to understanding the processes of seafloor spreading on a global scale.

The Amerasia Basin is a composite basin, made up of alternating ridges and basins. Despite numerous attempts, very little of the basin can be understood in terms of the patterns and processes of plate tectonics. Most constraints on basin history are derived from observations from the adjacent continents, inferred from stratigraphy and structure through model-based interpretations. On this basis, the Amerasia Basin, to the best of our knowledge, was formed entirely during the Mesozoic and has been tectonically inactive since. The primary model of basin formation, the "windshield wiper," defines the overall tectonic flow as a sweeping motion of northern Alaska and Eastern Siberia away from the Canadian Arctic Archipelago.. Most hypotheses about basin history attempt to fit the basin's features into this tectonic framework.

Constraining the history of the ocean through observations made on the adjacent continents returns to pre-plate tectonic practices, when little was independently known about the structure and history of the ocean basins. Recent work, motivated by the extensive mapping to establish Extended Continental Shelves, has raised questions about whether the Amerasia Basin is floored by oceanic crust, suggesting instead that the bulk of the basin is underlain by hyper-extended continental crust. Future research in this basin should focus on establishing the structural and historical relationships between the various basinal features and clearly delineating the extent of oceanic crust in the basin. Establishing this history in geologic time will be critically dependent on scientific ocean drilling.