Axial Valley Morphology of the Gakkel Ridge [8˚W - 88˚E]: Seabeam and Hydrosweep Bathymetry from the Arctic Mid-Ocean Ridge Expedition (AMORE 2001).

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The US Coast Guard Cutter *Healy* and the German research vessel *Polarstern* surveyed and sampled the Gakkel Mid-Ocean Ridge (MOR) as part of a joint US-German effort to understand the largely unexplored Arctic Ocean; the Arctic Mid-Ocean Ridge Expedition (AMORE) in August and September 2001. In addition to geologic sampling, both ships acquired multibeam bathymetry: Seabeam 2112 from *USCGC Healy* and Hydrosweep from the *RV Polarstern*. The bathymetric results from this expedition are an outstanding success far exceeding the expectations of either group. Favorable ice and weather conditions allowed *Healy* and *Polarstern* to operate separately during much of the expedition, providing more than three ship months of total data. The total surveyed region covers ~1000 km from the Lena Trough at 8˚W to 88˚E, significantly increasing bathymetric coverage along the axial and near-axis regions and providing the first data for the western Gakkel Ridge. At current data collection rates it is estimated that the AMORE cruise will contribute over 14 million bathymetric soundings, nearly doubling the present Arctic bathymetric database. The resolution of these data is significantly better than previously existing bathymetry and reveals geologic detail critical to understanding the segmentation and processes of this ultra-slow spreading MOR. The new bathymetry data show three distinct magmatic-tectonic regions. The western segment [8˚W - 3˚E] contains a series of five elongate volcanic highs that are quasi-continuous, and separated by short regions, most of which are populated by small volcanic cones. This clear volcanic and bathymetric segmentation is almost perfectly linear and occurs in the absence of any ridge offsets, suggesting that magmatic segmentation is occurring independently of offsets and may therefore be controlled by mantle processes. The central segment [3˚E - 11˚E] displays little bathymetric evidence of volcanism, and dredging recovered virtually little to no basalt. The axial depth increases significantly compared to the western segment, while the bounding fault walls become high-angle fault planes with vertical throws in excess of 1000m. Further eastward, beginning about 15˚E, punctuated volcanism occurs throughout the region, forming large localized volcanic centers with little significant lateral extent along strike. These volcanic centers are separated by lengthy ridge sections of highly faulted and tectonized seafloor. This variable behavior of the Gakkel Ridge is apparent only through a combination of bathymetry and geologic sampling. In the central region, domal features believed to be volcanic turned out to be peridotite, and many fault exposures believed to be “peridotite walls” gave rise to only basalt in the dredge. There is an important juxtaposition of tectonic and volcanic products and processes throughout the entire surveyed area of the ridge. Because spreading rate decreases progressively eastward, these irregular variations along the ridge suggest that spreading rate alone is not the controlling parameter of volcanism and tectonics within this region.