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Kinematic and tectonic peculiarities of ultra-slow spreading ridges

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This paper is dedicated to ultra-slow spreading ridges. They are distinguished as ridges with spreading velocities less than 2 cm/year. As it was shown by recent studies, these ridges are characterized by significant peculiarities of deep structure, topography and accretion mechanisms different from ridges with higher velocities. They are located in North Atlantic (Reikjanes, Kolbeynsey, Mohns, Knipovich), Arctic (Gakkel ridge, Lena trough), and southern part of the Indian Ocean (South-Western Indian ridge (SWIR)).
Ridges located near hotspots (Reikjanes, Kolbeynsey ridge, central part of SWIR) show structure changing with increase of proximity of hotspots. Far from hotspots axial volcanic ridges (AVRs) are short, high and offset by large non-transform offsets (NTOs) located in axial valley. Near hotspots the ridges are characterized by axial rise with long AVRs offset by small NTOs located on axial rise. These features are explained by influence of mantle flow from hotspots initiating the increase of mantle temperature. It results in decrease of lithospheric brittle layer with approaching to hotspot and subsequent change in accretion mechanisms, faulting patterns and lithosphere rheology.
Several segments of ridges (16–25° E SWIR, 8° W-3° E) are characterized by structure similar with slow spreading Mid-Atlantic ridge (MAR). The rift valley is occupied by regularly spaced AVRs offset by small NTOs. Basalts prevail in dredges. Flanks of the ridges have the similar structure with MAR.
The most significant portion of ultra-slow spreading ridges is characterized by unique segmentation (eastern and central part of Gakkel ridge, Knipovich, Mohns ridges, Lena trough segments in the eastern and western parts of SWIR) comprised of magmatic and amagmatic segments. The first ones are short centers of focused magmatic activity structurally resembling central parts of segments of MAR. The second ones are 35-150 km long portions with reduced or almost absent volcanic activity. Serpentinised peridotites prevail in dredges there. Flanks are formed by smooth seafloor terrain comprised of large blocks of serpentinised peridotites accreted along detachment faults.
Spreading kinematics complicates structural and tectonic patterns of rift zones. It influences segmentation, fault pattern and extent of magmatic supply. Segments with highly oblique spreading prevail among ultra-slow spreading ridges. Extremely high obliquity (40-50°) together with the lowest spreading velocities (less than 1,3 cm/year) results in the lowest effective spreading rates (0,8-0,9 cm/year) and subsequent formation of the longest amagmatic portions of Lena trough and eastern parts of SWIR and Gakkel ridges. Under conditions of oblique spreading magmatic segments and faults in their vicinity orient perpendicular to the spreading direction. Amagmatic segments and rises on their flanks orient subparallelly to the spreading direction. The most complicated segmentation and fault pattern are observed at the Knipovich ridge where the fault pattern includes faults both subparallel and subperpendicular to the spreading direction. Their number changes from segment to segment with spreading obliquity.