Regional stress field computation along the West Svalbard margin (Vestnesa ridge): Effect of the glacial isostatic adjustment.

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Release of greenhouse gasses is of major concern when it comes to climate change. Large amount of those gases are released through faults and fractures at the ocean floor, forming pockmarks at the surface. Understanding the formation of pockmarks and the fracture - fault network underlying them, is thus of first importance to apprehend the dynamics of gas seepages. We suggest that such fractures are closely related to the regional stress field and thus control by the combination of large scale tectonic processes, sedimentation - erosion mechanism and reactivation of inherited structures in the underlying basement.

The present study focus on the calculation of the regional stress field along Vestnesa ridge, a key location for methane seepage and pockmarks study. This area is located in a tectonically active region, boarded in the west by the Atlantic ridge and two major transform faults. In addition, deglaciation since the last glacial maximum (LGM), has induced a rebound of the lithosphere which also affects the stress field of the area including Fennoscandia, Svalbard and Greenland. However, it is difficult to estimate the effect of post-glacial rebound on the regional stress field, especially in a zone where the stress is mostly dominated by the effect of the Atlantic ridge push. To assess this problem, we built a time-dependent mechanical model of an elastic crust and viscoelastic mantle underlying the area of interest. We apply an ice cover on the surface of the model that varies according to the time-dependent ice-thickness model of Patton et al., 2016; 2017. The model runs for 50 000 yrs which includes 1) a glaciation phase till the last glacial maximum (LGM) at about -16000 yrs and 2), a deglaciation phase from the last LGM up to present time.

Preliminary results show that the amplitude of the stress change resulting from glacial adjustment, can be of the order of -2 MPa to 2 MPa along Vestnesa ridge. Moreover, the orientation of the maximum horizontal stress (\(\sigma_H\)) is modified according to the geometry and evolution of the ice cover, just as to the topography of the region affected by the lithospheric adjustment.