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High resolution reflection seismic profiling over the Møre- Trøndelag Fault Complex, Norway

E. Lundberg (1), A. Nasuti (2,3), and C. Juhlin (1)

(1) Department of Earth Sciences, Uppsala University, Sweden (emil.lundberg@geo.uu.se), (2) Department of Petroleum Engineering and Applied Geophysics, NTNU 7491 Trondheim, Norway, (3) Geological Survey of Norway (NGU)

Two seismic profiles, each extending 7 – 8 km, were recorded in June 2008, as a part of a detailed and integrated geological- geophysical study on the Møre- Trøndelag Fault Complex (MTFC). The 300 km long and 50 km wide MTFC is one of the most prominent fault zones of Norway. Offshore it separates the North Sea basin system from the Møre and Vøring basins. It strikes ENE – WSW and onshore parallels the south central Norwegian coast. The MTFC probably formed during the Scandian orogeny (Grønlie and Roberts, 1989), although an older precursor fault may have existed, and is still active today (Olesen et al. 2004). It has been reactivated several times and, therefore, contains a variety of fault rocks. Four main phases of activity along the MTFC have been revealed reflecting the collapse of the Caledonian mountain chain followed by Permian rifting and later Late Jurassic rifting of the northern North Sea (Gabrielsen et al. 1999) and finally the Cenozoic uplift of the Norwegian mountains with offshore basins subsiding (Faleide et al. 2002, Redfield et al. 2005). The MTFC has strongly influenced the shape of offshore basins, as well as the onshore landscape, and is still affecting the regional stress pattern. The seismic study and the future integrated models are, therefore, of interest to offshore hydrocarbon exploration, as well as land planning and natural hazard assessment in Mid-Norway and will also generate new knowledge on fault mechanics.

The two seismic profiles were located on each side of the Tingvollfjord in the vicinity of Meisingset. A VIBSIST 1000 mechanical hammer was used as a source. 28 Hz single geophones were placed 20 m apart. Source points also had a nominal spacing of 20 m with 240 – 300 channels recorded using a SERCEL 408UL recording system with a sample rate of 1 ms. The aim was to image structures in the upper crust down to a depth of 4 km. Processing of the seismic data has been challenging, due to the crookedness of the profiles and the high topography in the area. Reflections in the upper 3 km that can be correlated to strong topographic lineament on the surface have been found. The faults are expected to be steep and might therefore be difficult to image directly. Offsets in bedrock structure can then be used for tracing the faults at depth.

The reflection seismic data will be integrated with detailed gravity, magnetic analysis and resistivity profiles. Rock sampling and petrophysical measurements on densities, magnetic susceptibilities and seismic velocities will constrain the geophysical models further. The final product of the study will be a numerical/rheological model that will be used to simulate the potential influence of the MTFC on the tectonic evolution of the region through time.