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Present-day stress orientations in Norway as deduced from stress-release features and active, post-glacial reverse faulting

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Fieldwork was conducted in different parts of Norway – Finnmark, Trøndelag and the Oslo Region – with the purpose of detecting and measuring stress-relief features, induced by quarrying and road works, and to derive from them valuable information on the shallow-crustal stress state. These investigations followed the earlier discovery of the currently active, post-glacial Stuoragurra Fault in northern Norway, a reverse fault that was the locus of a 4.0 magnitude earthquake in 1996. Two kinds of stress-relief features were considered in this study. The first consists of drillhole offsets that were found along blasted road-cuts and which were triggered by the sudden rock unloading following the actual blasting. Vertical axial fractures found in the concave remains of boreholes represent the second kind of stress-relief feature. The axial fractures are tension fractures produced by gas overpressure inside the drillhole when the blast occurs. As such, their strike reflects the orientation of the ambient maximum horizontal stress axis. Stress release- features are less common in the Oslo Region than in Finnmark or in Trøndelag, suggesting that stress magnitudes at shallow depths in the Oslo Region are lower than in the two latter regions. In Finnmark, mechanical considerations of the slip planes offsetting some of the drillholes lead to the conclusion that the magnitude of the maximum horizontal stress at the surface is in the range $\sim$0.1 to $\sim$1 MPa. In Trøndelag, the Møre-Trøndelag Fault Complex appears to separate two distinct stress provinces, as already suggested by previous numerical modelling studies. In the three studied areas, the borehole offsets show mostly reverse-slip displacements to the E-SE and the axial fractures trend NW-SE on average, in agreement with NW-SE compression induced by North Atlantic ridge-push forces. Isolated observations of

reverse-slip displacement of drillholes in other parts of Norway also show the same general compressional trend.