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The hunt for sliding planes in a phyllitic rock slide in Western Norway using airborne electromagnetic mapping

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The inner Aurland fjord and the adjacent Flåm valley (Western Norway) are subject to a potential rock slide comprised of creeping rock- and debris masses. From repeated GPS measurements we understand that rock and debris movements are constrained by precipitation and snow melt. Based on this assumption the local municipality and regional hydroelectricity company are evaluating the option to drain the unstable area with a more than 10 km long drainage tunnel to a nearby hydropower reservoir. We conducted an airborne electromagnetic (AEM) mapping survey to find indications for the sliding planes and to assess the tunnel corridor for potential tunneling hazard areas.

Unstable rock areas some 1.000 meters above seawater have been mapped as massive phyllite intercepted by numerous tension cracks opening up to several meters. Field observations also point out that significant amounts of surface water in streams on the mountain plateau disappear in some of these cracks and surface again several hundred meters down the slope. Potentially sliding planes provide the water pathways and the changes in water pressure can cause instability. As the phyllite will weather to fine grained clay the water saturated sliding planes should be an ideal target for AEM as they are very conductive (1-10 Ohm*m) in comparison to the resistive undisturbed phyllite or nearby gneiss (> 1.000 Ohm*m).

From our first AEM data interpretation we find widespread areas with high conductivity, which are most likely caused by either water saturated, fine grained sliding planes or fault zones at the phyllite / gneiss interface. At this point, financing for drilling is pending to transform the geophysical maps to a firm geological model. Based on the AEM results, we are formulating a joint research program involving detailed hydrological investigations, monitoring of formation water pressure, movements, meteorology, more detailed structural mapping and geophysical ground follow up of the airborne data.

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