Uplift Record in Hydrocarbons and Sulphides in South Norway

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When a small, but once economic gold deposit in southeast Norway returned different Re-Os ages for occurrence-specific pyrite and hydrocarbon samples in a study ten years ago, some questioned the credibility of Re-Os dating. With one Re-Os isochron age less than ten million years for one sample, eyebrows were raised. Ten years on, additional field work and dating affirms an array of ages in the Phanerozoic, and teaches us that old and deep crustal wounds may never heal. That is, tectonic reactivation through uplift exploits old pathways. Now, with additional data, new thinking, and a database carrying consistently young ages from other studies in the region, we must embrace an on-shore Mesozoic-Cenozoic history in Scandinavian bedrock.

The accuracy of Re-Os ages from small veinlets and fractures, with or without sulphide, can be safely and soundly interpreted in a geologic context rooted in the uplift history of Scandinavia. The most comprehensive Re-Os data set is from one locality in southeast Norway, the Eidsvoll gold deposit. Other localities return ages with highly anomalous Re concentrations in their molybdenite indicating uplift and loss of volatiles at regional scales. Still other locations in Norway, and on other continents, preserve molybdenite in stylolite-like structures. In such cases, expected replication of Re-Os ages may be compromised. Other samples presented as molybdenite for Re-Os dating are in fact samples where shear and frictional heating during faulting in organic-rich shales has produced a hard, polished mirror-like surface. Re-Os dating of these surfaces provides ages for frictional heating of organic-rich shale along glide planes. Although these samples may look like molybdenite on casual glance, their high common Os and context indicates faulted shale in organic-rich source rocks. This feature is common at some Paleoproterozoic gold mines in northern Finland.

The AIRIE Program continues to make sense of unusual occurrences of bitumen, pyrobitumen, and hydrocarbon both on-shore and off-shore Norway to reconstruct the uplift history of this critically important region for oil. Both sulphides, hydrocarbons and shales are candidates for tracking pore and fracture filling, and post-depositional faulting.