Does high molybdenum enrichment in sedimentary records always require past anoxic conditions?

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Molybdenum (Mo) is a well-established proxy to detect and estimate the intensity of sulfidic conditions that were prevailing within ancient oceans. Usually, highest Mo enrichments correspond to severe euxinia.

The Montney Formation is an Early Triassic tight gas reservoir, located to the northeast of the Cordilleran deformation belt in the Western Canada Sedimentary Basin (WCSB). Medium- to coarse-grained siltstones of the Montney Formation predominantly deposited in lower shore face to offshore environments with a complex diagenetic history. Organic petrography studies show no evidence of primary organic matter (OM) present in the studied samples. The OM comprised almost entirely of migrabitumen (solid bitumen) that were migrated into the organic-lean, siltstones of the Montney Formation as liquid hydrocarbon [1].

Preliminary results show high Mo concentration (18 ± 19.5 ppm) and enrichment factor (22.7 ± 24.4), suggesting anoxic paleo-depositional conditions. To confirm this first impression, Mo XAFS analyses were run on a selection of samples. For all samples tested, preliminary interpretation of XANES and EXAFS data collected, indicates that Mo predominant species is molybdenite ($Mo^{IV}S_2$), supporting a model where Mo enrichments result from diagenetic processes [2].

Sedimentological and petrographic evidence suggest a high energy, oxic sedimentary environment which is in contradiction with high Mo enrichment in the Montney Formation. Taken together, our preliminary dataset suggest that high Mo concentration in sedimentary records don't necessarily require euxinic conditions.

[1] Sanei *et al*. (2015) *IJCG* 150-151 296-305*;* [2] Ardakani et al. (2016) *EPSL* 449 311-320.