

Molybdenite under Stress: Dating the Contrarian Bou Azzer Co-Ni-As Deposit, Morocco

HOLLY STEIN^{1,2}, SAÏD ILMEN³, THOMAS OBERTHÜR⁴,
AARON ZIMMERMAN¹, LHO MAACHA³ AND
MOHAMED ZOUHAIR³

¹AIRIE Program, Colorado State University

²University of Oslo

³Managem Group

⁴Bundesanstalt für Geowissenschaften und Rohstoffe

Presenting Author: holly.stein@colostate.edu

The Co-Ni-As deposits of Bou Azzer floored by the Anti-Atlas Supergroup have a rich orogenic history reaching back to the Mesoproterozoic¹. Relicts of a rift-generated, then obducted oceanic crust hosting the Bou Azzer mineralization present as highly sheared ~760 Ma allochthonous ophiolite complexes intruded by younger Neoproterozoic quartz diorites. The Bou Azzer ore bodies are highly deformed and hosted either within serpentinite or more commonly along the contact with the intrusions². Many disparate age models exist for Bou Azzer mineralization, and prevailing models advocate Neoproterozoic, Variscan, and/or Late Triassic ore genesis.

Re-Os dating of sulfides in poly-deformed environments is fraught with challenges as multiple, temporally distinct generations of sulfides may be present. If more than one generation carries significant Re, a range of ages may result as documented in the first Re-Os molybdenite dating of Bou Azzer (350-400 Ma)³.

Here, we present new Re-Os ages derived from unusual mirror-like, woody-textured, molybdenite-cryptocrystalline quartz occurrences syn-kinematically deformed with widespread chlorite. Our results clearly outline a 385-390 Ma event associated with molybdenite-chalcopyrite deposition with an Os isotope ratio that may reflect influx of primitive fluids in the late Devonian. Further, one set of samples contains significant common Os, whereas the other set displays Os isotopic compositions as expected for molybdenite (no common Os). Both sets have similar, but distinct ages with molybdenites containing common Os being slightly younger (375 Ma).

Proterozoic shales as source rocks are difficult to reconcile with our new Re-Os data. Rather, Late Devonian mineralization appears to have involved fluids from the mantle and potentially Neoproterozoic oceanic crust.

Brannerite, as pristine inclusions in the Co-Ni arsenide ore mineral skutterudite, also gives Late Devonian U-Th-Pb ages (385-375 Ma)⁴. Thus, a significant ore-forming event at Bou Azzer is Late Devonian, calling for a significant revisit of tectonic and Co-Ni-As ore events in this region of Morocco.

This project was initiated and funded by the Managem Group.

¹Lahna et al (2020) *Journal African Earth Sciences* 171: 103946.

²Bouabdellah et al (2016) *in Mineral Deposits of North Africa*, Springer.

³Oberthür et al (2009) *Economic Geology* 104: 1065-1079.