

Re-Os Isotopic Evidence for Cenozoic Mineralization in the Central Pennsylvania Valley and Ridge Province

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Hypotheses concerning processes and timing of hydrothermal sulfide mineralization in the central Pennsylvanian Appalachians utilize Mississippi Valley-type (MVT) models with Paleozoic ages. To examine this model, we studied sulfide-bearing veins from seven sulfide occurrences that contain pyrite < galena < sphalerite and occurs in central Pennsylvania, USA. Fault breccia pyrite from the Skytop occurrence (central PA) along with pyrite and chalcopyrite from the Perkiomen Creek (eastern PA) forms a nine point Re-Os isochron yielding an age of 33.8 ± 4.8 Ma and an $^{187}\text{Os}/^{188}\text{Os}$ initial ratio of 0.18 ± 0.05 . Three pyrites from the Keystone mine (central PA) and Thompson mine (central PA) form a trend that suggests an age of 35 MA. Veins of sulfide (pyrite predominantly) from the Logan Valley, Albright and Scrub quarry do not fall on any trends and contain less Re and Os. The Re-Os isotope data do not fit current models for sulfide generation in central Pennsylvania that invoke MVT hydrothermal processes. These MVT models imply that mineralization in the area formed in the late Paleozoic at relatively low temperatures ($120 \pm 40^\circ\text{C}$) with metals originating from surrounding sedimentary rocks. The data from the present study indicates that a younger mineralization event overprinted the MVT type mineralization (represented by the vein pyrite) across the whole orogen. This hydrothermal activity had not previously been hypothesized or recognized. The timing of the younger mineralization event coincides with two Cenozoic events in the Appalachian Basin: the Chesapeake Bay impact and Eocene volcanism in the southern portion of the Nittany anticlinorium.