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The Alabama Graphite Belt Unveiled: Re-Os dating insights

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The Alabama Graphite Belt lies within the southern end of the Appalachian mountains in the eastern Blue Ridge terrane. This graphite- and vanadium-rich belt has a spatial footprint of ca. 1,100 km^2 and an inferred graphite resource of at least 2 million tons[1]. High-grade flake graphite occurrences are distributed at the weight percent-level in a handful of rock types (schists, gneisses, quartzites, and pegmatites) within the Higgins Ferry Group and Poe Bridge Mountains Group of the Coosa block[1]. The exact timing of graphite mineralization, however, has hitherto been obscured by polyphase metamorphism related to Acadian (ca. 410-380 Ma), Neoacadian (366-350 Ma) and Alleghenian (ca. 325-260 Ma) mountain building events.

Here we present preliminary graphite Re-Os dating results for graphite-bearing assemblages sampled obtained from the Coosa graphite property. Petrographic analysis reveals both disseminated and vein-type graphite within amphibolite facies schist. Graphite forms foliation parallel layers and lenses in garnet mica schists, while crosscutting fractures predominate in sheared schistose samples. Disseminated flake graphite, which commonly forms alongside vanadium-rich muscovite, are interpreted to have formed from prograde metamorphic processes that converted carbonaceous matter into graphite via graphitization. In contrast, vein textures are consistent with having formed from late-stage metamorphic processes.

Initial Re and Os estimates of the graphite concentrations range up to 200 ppb Re and 4400 ppt Os. Graphites also record $^{187}Os/^{188}Os$ initial values elevated above mantle $^{187}Os/^{188}Os$ compositions and suggest Re and Os were primarily derived from crustal sources. These crustal $^{187}Os/^{188}Os$ initial values along with our graphite Re-Os dating results are then discussed in the context of the broad thermo-tectonic processes that operated in the Alabama Graphite Belt to generate graphite mineralization.

[1] Wilson et al. (2015), AGP Mining Consultants. [2] Stowell et al. (2021), GSA Field Guide 61, 1-38.