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Geochemistry of Archean Mafic Amphibolites from the Amsaga Area, West African Craton, Mauritania: Occurrence of Archean oceanic plateau

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While Archean terrains are mainly composed of a TTG (Tonalite-trondhjemite-granodiorite) suite, more mafic lithologies such as amphibolites are also a typical component of those ancient terrains. Although mafic rocks represent only $\sim$10% of the Archean cratons, they may provide key evidence of the role and nature of basaltic magmatism in the formation of the Archean crust as well as the evolution of the Archean mantle.
This study focuses on the Archean crust from the West African craton in Mauritania (Amsaga area). The Amsaga Archean crust mainly consists of TTG and thrust-imbricated slices of mafic volcanic rocks, which have been affected by polymetamorphic events from the amphibolite to granulite facies.
We report the results of a combined petrologic, Sm-Nd isotopic, major element and rare earth element (REE) study of the Archean amphibolites in the West African craton.
This study was conducted in order to characterize these rocks, to constrain the time of their formation and to evaluate their tectonic setting and their possible mantle source.
Our petrological observations show that these amphibolites have fine to medium granoblastic and nematoblastic textures. They are dominated by amphibolite-facies mineral assemblages (mainly amphibole and plagioclase), but garnet and clinopyroxene occur in a few samples.
These amphibolites have tholeiitic basalt composition. On a primitive mantle-normalized diagram, they display fairly flat patterns without negative anomalies for either Eu or Nb-Ta. We have shown using Sm-Nd whole rock isotopic data that these amphibolites formed at 3.3 $\pm$0.075 Ga. They have positive εNdi values (+5.2 $\pm$ 1.6). These samples show isotopically juvenile features, which rule out the possibility of significant contamination of the protolith magmas by ancient continental crust.
Based on these geochemical data we propose that the tholeiitic basalts were formed in an oceanic plateau tectonic setting from a mantle plume source and that they have a depleted mantle source. It is the first time that such a signature is observed in the Archean part of the West African craton, and would suggest a widespread bimodal distribution of trace elements signature in all Archean basalts.