Origin and evolution of the Mesoarchean Aouéouat Greenstone Belt and associated magamatism

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Archean greenstone belts provide a unique archive of early Earth processes. A growing database of geochemical and isotopic data from greenstone belts worldwide is aiding the development and refinement of models of pre-Wilson Cycle tectonics and crustal evolution. Here we present, for the first time, new geochemical and isotopic data from a previously unstudied greenstone belt; the Aouéouat Greenstone Belt, Réguibat Shield, West African craton.

We dated representative ultramafic – felsic greenstone belt lithologies using U-Pb zircon LA-ICP-MS to 3.00-2.99 Ga, whereas TTG-plutonic rocks crystallised between 2.97 and 2.93 Ga. This places the Aouéouat Greenstone Belt firmly in the Mesoarchean, a time in Earth's history for which there is great debate as to the active tectonic processes.

In addition to the U-Pb zircon data, we present Nd isotope and whole rock major and trace element geochemistry of the rocks to help elucidate the origin and evolution of the Aouéouat Greenstone Belt. The oldest rocks in the volcanic stratigraphy are ultramafic-mafic and possess trace element and isotope signatures (Th/Nb, rare earth element, εNd) consistent with the tapping of a depleted mantle source. In contrast, younger mafic to felsic volcanic rocks exhibit trace element patterns that suggest either an enriched source, or crustal contamination. The TTG-plutonic rocks exhibit trace element patterns akin to those seen in TTG rocks worldwide, with characteristic LREE enrichment.

The results add to the global geochemical and geochronological database that is important for understanding early Earth processes and greenstone belt formation. There were two distinct processes involved in creating Aouéouat belt stratigraphy. A possible model is presented and reference made to the classical subduction vs sagduction debate.