Petrographic and geochemical signatures of Paleoproterozoic formations of the Massigui square degree sheet (southern Mali): Geodynamic Implications

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The Massigui square degree sheet (MSDS) belongs to the northern margin of the Man Shield, one of the two shields of the West African Craton (WAC), the other being the Reguibat Shield. It is located on the northern edge of the Bagoé Basin which is the largest Paleoproterozoic basin in southern Mali. This basin extends to the south, into Côte d'Ivoire, where it is named "Boundiali Belt". It disappears to the north below the Neoproterozoic-Carboniferous Taoudeni basin.

The MSDS is made of metavolcano-sedimentary rocks that are intruded by various generations of plutonic bodies. Both metavolcano-sedimentary and plutonic rocks are of Paleoproterozoic age. It is transected, from the southwest to the northeast, by a shear zone located at the interface of the plutonites and the metavolcano-sedimentary rocks. This shear zone, called the Banifing Shear Zone (BSZ), extends from Côte d'Ivoire to the Taoudeni basin. It could correspond to the northern extension of the major shear zone of Sassandra, which separates Archean and Paleoproterozoic domains in Côte d'Ivoire.

The metasedimentary rocks of the MSDS are made of metagreywackes, metapelites, schists and locally micaschists. They essentially contain quartz, plagioclase and micas (biotite ± muscovite). The metagreywackes contain locally, microcline, pinnite, amphibole and garnet. They differ mainly from the metapelites by the size of the clasts and the proportion of the matrix. The metavolcanic rocks intercalated with the metasedimentary rocks are usually metadacites and metarhyolites. The metavolcano-sedimentary series is folded and metamorphosed in the greenschist facies, generally biotite zone. Metamorphism can reach the amphibolite facies in the BSZ or near the plutonic rocks.

The plutonic rocks show three magmatic units: (1) Massigui granitoids; (2) Tiéfala-Syobougou dioritoids; and (3) Sodioula foliated granitoids.

Massigui granitoids belong to the Massigui batholith, which occupies the western part of the MSDS. The Tiefala-Syobougou dioritoids are located within or to the west of the BSZ. The Sodioula foliated granitoids are exclusively located within the BSZ. Both dioritoids and foliated granitoids strikes NE-NNE. Their orientation is parallel to that of the BSZ. Massigui granitoids are the oldest plutonic rocks in the area (~ 2112-2095 Ma), the Sodioula foliated granitoids are the youngest plutonic rocks (~ 2074 Ma) and the Tiefala-Syobougou dioritoids are of intermediate age (~ 2106-2103 Ma).

All the plutonic rocks define a calc-alkaline trend with K-enrichment without a participation of alkaline magma. The forms of the rare-earth spectra as well as those of the spidergrams show similar patterns which suggest that the plutonic rocks would derive from an enriched source similar to that of the upper-mantle of the subduction zones. The Massigui granitoids and the Tiefala-Syobougou dioritoids fall in

the field of Volcanic Arc Granites (VAG) opposite to the Sodioula foliated granitoids, which predominantly occur in the field of Syn-Collisional (Syn-COLG) Granites.
The metavolcano-sedimentary rocks of the MSDS share the same magmatic trends as the plutonic rocks, mainly rocks of granodiorite composition. They still have the magmatic characteristics of their protolith. The rare-earth patterns and spidergrams indicate that the metavolcano-sedimentary rocks have formed in a subduction environment.

Keywords: Massigui; Square-degree sheet; Bagoé; Metavolcano-sedimentary rocks; Paleoproterozoic; Granitoids; Dioritoids; Banifing Shear Zone; Geochemistry; Geodynamic.