The Paleoproterozoic Baoulé-Mossi domain, West African Craton: plate tectonics at 2.3-2.0 Ga?

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Despite advances in understanding the evolution of the West African Craton (WAC), much debate still hinges over its geodynamic evolution. In the case of the Paleoproterozoic Baoulé-Mossi domain, part of the problem is that most studies are localized and fail to present large-scale correlations. To address this, we present the integrated results of zircon U-Pb geochronology, O and Hf isotopes, and whole-rock geochemistry datasets obtained from felsic intrusions across Ghana, Burkina Faso, Mali and Guinea.

Combining the new and existing U-Pb age data reveals that magmatism was continuous for approximately 150 Myrs, and involved migration of a magmatic front from east to west. Mafic and felsic magmatism was coeval, and a small amount of inherited zircons as old as 3.5 Ga were identified.

The Hf- isotope data reveal the existence of two different crustal domains, with subtlely different Hf isotope signatures. These data also hint at a crustal source component potentially as old as 2.8 Ga in some rocks. The two isotopic domains are separated by a less radiogenic sliver of crust across the Banfora Belt. O isotope compositions (zircon $d^{18}O$ from 6.5 to 11 ‰), corroborate evidence for a crustal source.

Geochemical data from felsic intrusions indicates that the studied rocks are not TTG equivalents as previously described but are more akin to modern granitic intrusions. The intrusions are either two mica (muscovite/biotite) or one mica (biotite), and some are amphibole rich. These intrusions are mainly calc-alkaline and magnesian and range from metaluminous (SiO_2<65%) to peraluminous (SiO_2>65%). They predominantly show arc-type trace element signatures.

The combination of the different spatially extensive data sets favors a plate tectonic regime for the period between 2.3 and 2.0 Ga. Under this scenario, two, predominately juvenile, crustal blocks developed in an arc-type setting. This evolved into a continental arc-type setting and later, upon the indentation of the Archean Kenema-Man domain at 2.1-2.0 Ga, into a continent-continent collisional setting.