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Tectonic significance of the Buem Structural Unit within the Pan-African Dahomeyide orogen, West African Craton

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The Dahomeyide orogen, at the southeastern margin of the West African craton (WAC), is a collisional orogen comprising, from west to east, a basement complex, inverted passive margin sequences, HP rocks marking the suture zone of the Pharusian ocean, and active margin units. The formation and growth of the Dahomeyide orogen resulted from east-dipping subduction at ca. 780 Ma of the WAC to subsequent continent-continent collision at ca. 610 Ma with the Benino-Nigerian Shield (upper plate). The Buem structural unit (BSU) represents an oceanic terrane about 50 km west of the main suture zone and occurs within the passive margin sequences of the Dahomeyide orogen. The significance of the BSU within the Dahomeyide orogen is poorly understood and its relationship to the Pharusian suture zone is unknown. The suture zone comprises eclogite and granulite gneisses together with mafic-ultramafic igneous rocks. Rocks of the BSU are low-grade (lower greenschist facies) metamorphosed mafic-ultramafic and sedimentary rocks. The mafic-ultramafic rocks include volcanic rocks, gabbro and serpentinised peridotite. The presence of pillow lavas and hyaloclastite, evidence for seafloor hydrothermal alteration and geochemical analysis support that the volcanic rocks formed in an oceanic setting. Major and trace elements data show the presence of N-MORB, E-MORB and alkaline (OIB-like) volcanic rocks. The εNdt (+4 to +6) and εHft (+3 to +17) values for the volcanic rocks are comparable with rocks from MOR and OI settings. This association of rocks could point to magma generation in a divergent setting. Structural analysis indicates that the pillow lavas were folded along an NNW horizontal plunging fold axis during the Pan-African orogeny. Processing and modelling of geophysical data reveal ENE-trending long-wavelength (>5 km), deep (>3.5 km-depth) magnetic anomalies underlying the BSU that are continuous and along-strike with the basement regional structures of the WAC to the West, suggesting overthrusting of the BSU onto the WAC during the Pan-African orogeny. Both structural and geophysical data suggest the formation of the Buem volcanic rocks prior to the Pan-African plate convergence. Hence, the BSU reveals a rifting history before subduction and continent-continent collision during the Pan-African orogeny at the southeastern margin of the WAC. The formation of the Buem volcanic rocks might have occurred within the time bracket of the breakup of the supercontinent Rodinia (ca. 800 Ma) with its emplacement involving both accretionary and collisional tectonics. Two possibilities exist for the origin of the BSU: 1). a pre-Pan-African orogeny autochthonous oceanic lithosphere in a separated basin from the Pharusian Ocean or 2). a fragment of an allochthonous Pharusian oceanic lithosphere incorporated into the accretionary wedge of the Dahomeyide orogen. The Dahomeyide orogen thus preserves a record of Wilson cycle; i.e. rifting leading to the opening of an oceanic basin and continent-continent collision, involving the closure of the oceanic basin.