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Crustal evolution in the West African Archaean Craton in Sierra Leone, Liberia, Guinea and Ivory Coast: A review

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Post-Ebola the countries of West Africa need a solid geological basis on which to rebuild their mineral economies. There is a dearth of such information in the modern literature. Here a new synthesis of the geology and geochronology of the West African Archaean Craton in Sierra Leone, Liberia, Guinea and the western part of Ivory Coast is presented to show that the Craton comprises four main geological units:
1. The oldest crust is made up of 3.5-3.6 Ga TTG (tonalite-trondjemite-granodiorite) gneisses. These only outcrop in the east of the craton in Guinea but their presence is indicated elsewhere in the central part of the craton though xenocrystic zircon cores in younger rocks.

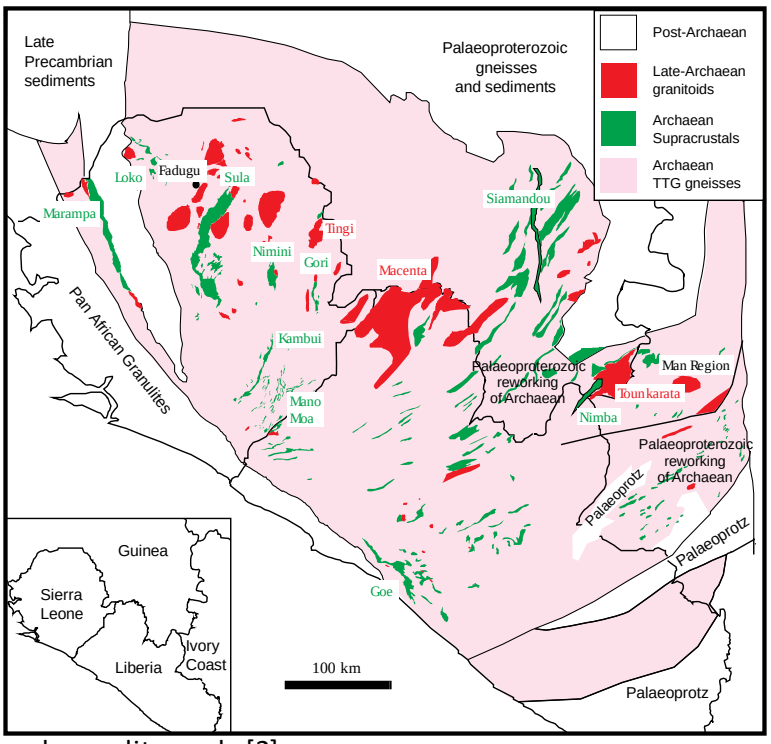

Figure 1. New compilation of the Archaean geology of Sierra Leone, Liberia, Guinea and Ivory Coast

2. The major rock type found throughout the craton is 3.26-2.85 Ga TTG gneiss. In detail these magmas are thought to have formed in two episodes one between 3.05-3.26 Ga and the other between 2.85-2.96 Ga. The presence of inherited zircons in the younger suite indicate that this event represents the partial reworking of the older gneisses. 3.4 Ga eclogite xenoliths in kimberlite derived from the sub-continental lithospheric mantle are thought to be the restite after the partial melting of a basaltic protolith in the production of the TTG magmas [1].
3. Supracrustal rocks form linear belts infolded into the TTG gneisses and are metamorphosed to amphibolite and granulite grade [2]

4. They are of different sizes, contain a variety of lithological sequences and may be of several different ages. The larger supracrustal belts in Sierra Leone contain a thick basalt-komatiite sequence derived by the partial melting of two different mantle sources, unconformably overlain by a sedimentary formation. Gold mineralisation is associated with the later deformation and metamorphism of the supracrustal suite.

5. A suite of late Archaean granitoids formed by the partial melting of the TTG gneisses in a craton wide deformation-metamorphic-partial melting event at 2800 +/- 20 Ma. This is thought to be the 'craton-stabilisation' event.

The geology and geochronology of the craton is not well known and this presentation will identify a number of geological, petrological and geochronological problems which are still to be solved.

References:

[1] Rollinson HR (1997) Nature 389: 173-176

[2] Rollinson HR (1999) Contrib Mineral Petrol 134: 86-101

[3] Rollinson HR (1978) Nature 272: 440-442