The Moroccan Sahara, Western Reguibat Shield, West African Craton: a Dyke Swarm Bonanza !

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Numerous mafic dyke swarms with various trends are found in the south-western and oldest portion of the Reguibat Shield, of the West African craton (WAC), Moroccan Sahara. The mafic granulite of the basement: the Archaean terrane near Aousserd (the so called Tiris Complex dated between 2.9 and 2.5 Ga) has been dated by U-Pb zircon and apatite method at 2931 ± 10 Ma with metamorphic overprint at 2763 ± 13 Ma (zircon)/ 2756 ± 12 Ma (apatite) and a second overprint at 2662 ± 9 Ma recorded only in apatite. These two events correspond to the age of 2733±2 Ma of the Ahmeyim Great Dyke of Mauritania and prominent NW-trending swarm dated at 2688 ± 3 Ma of Moroccan Sahara, respectively. The relative chronology of these mafic dykes in the Aousserd area is (from oldest to youngest): NW-trending, E-trending, NE-trending, and N-trending. However, prior to this project there was no direct dating or geochemical analyses on any of these swarms. A NW-trending, 30 m-thick, >130 km-long dyke was sampled for U-Pb baddeleyite geochronology and yields an upper Concordia intercept age of 2688 ± 3 Ma. This dyke is cut by numerous NE- to NNE-trending dykes. One NW-trending and one NE-trending dyke cut a syenite intrusion dated at 2.46 Ga and thus must be younger than 2.46 Ga. Another NE-trending dyke intrude the Gleibat Lafhouda dated at 1.85 Ga and thus must be younger than 1.85 Ga. Most of the dykes are subalkaline basalts, but four dykes are alkaline trachybasalts, trachyte and phonolite. All dyke swarms are variably enriched in the light REE relative to the middle and heavy REE, although the N- and NW-trending swarms are more uniform (La/Sm_N = 1.3-2.0) relative to the E- and NE-trending swarm (La/Sm_N = 1.1-5.5). Sm-Nd isotopic data are consistent with variable sources

for dykes within each swarm. The dykes exhibit a wide range in Nd depleted mantle model ages (T_{DM}) from 1.8 to 3.3 Ga. The NW-trending swarm, including the dated 2688 Ma sample, have T_{DM} ages of 3.1 to 3.3 Ga and ε_{Nd} (2.7 Ga) between +0.6 and +1.5, with the exception of the dyke cutting the syenite intrusion with a T_{DM} of 2.8 Ga and an ε_{Nd} 2.7 of +2.5. The NE-trending swarm includes at least two clusters of dykes with T_{DM} ages of 3.1 to 2.9 and 2.2 Ga, the latter including one of the dykes that cuts the 2.46 Ga syenite intrusion. The N- and E- trending swarms include dykes with TDM ages > 2.9 Ga and ~1.8 Ga (estimated and ε_{Nd} 1.8 of +5.2 to +6.5). The 1.8 Ga model ages are slightly below a previously reported age of 1.90 ± 0.5 Ga for a NNW-NNE trending dyke set from this region (Aïfa et al., 2001). With only one exception, T_{DM} ages do not increase with decreasing MgO or increasing SiO_2 content, and a major role for crustal contamination is unlikely. The U-Pb geochronology and Sm-Nd isotope systematics are consistent with two or three intrusive events: 2688 Ma (and older ???), 1800-1900 Ma, and possibly ~2200 Ma. The oldest suite includes a significant older lithospheric component, and the high MgO content of these dykes is more consistent with and enriched mantle contribution rather than a crustal influence. The younger suite was derived by melting of more depleted upper mantle. Some dykes of the older suite and the two dykes with ~2.2 Ga model ages may include contributions from both the lithospheric and depleted upper mantle sources. In the same region, an Archean age obtained for the NNE-trending 2733 ± 2 Ma Ahmeyim Great Dyke of northern Mauritania; the 45 Ma age gap and contrasting trends suggest these two dyke events (2688 and 2733 Ma) are unrelated, but are evidence of widespread Archean intraplate magmatism in this portion of the Reguibat shield.