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Gold Mineralisation in the Precambrian of Southern Ethiopia

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The Precambrian of Southern Ethiopia is characterised by two distinct tectonostratigraphic terranes, namely the granite-gneiss terrane, and the ophiolitic fold and thrust belts, which are separated by repeatedly reactivated deformation zones [1, 2]. The Gold mineralisation contained therein, is characteristically in form auriferous quartz veins hosted in shear zones, confined to or closely associated with the ophiolitic fold and thrust belts. The auriferous quartz veins occur most commonly in the low-order shear zones, slightly away from areas of localised high-strain. They are hosted in different lithologies such as graphite-bearing metasediments, ultramafic schists, quartzofeldspathic gneisses, metabasic rocks, and deformed granitoids indicating the interplay of structure and lithology in the localisation of the gold mineralisation [1].

Gold veins are concentrated in dilation zones away from areas of constriction, bound by rigid and competent bodies which envelope incompetent layers (e.g. graphite-bearing metasediments and ultramafic schists), allowing for the formation of sizeable gold deposits, such as at Lega Dembi and Sakaro [1]. Within the constrictional zones where dilation is almost zero, the less competent metasediments are rare, gold mineralisation and associated quartz veining are almost absent [1].

Six (D0 to D5) deformational phases are genetically-associated with the repeated opening and closure of the supra-subduction ocean basins, and were accompanied by granitic magmatism between about 900 and 500 Ma [1]. The D0 and D1 structures are genetically-associated with the closure of the first two ocean basins (Bulbul-Kenticha and Megado) between ~880 Ma and 770-720 Ma, respectively. The D2-D4 structures are associated with the subduction of the youngest marginal basin (Moyale) and subsequent sinistral-transpressive collision that occurred ~670 - 550 Ma. The D3 structures represent widely-developed shortening zones which trend mainly N-S, and overprint earlier D2 N-S structures. The D4 structures are predominantly dextral strike-slip faults which trend NW-SE and offset the N-S trending D3/D2 structures.

Five tectonothermal events ((~1030±40 Ma), (>880 Ma), (800-750 Ma), (700-570 Ma), and (550-500 Ma)) are responsible for the granitic magmatism, deformation, associated metamorphism and post-Oorogenic cooling which occurred during the East African Orogen [1],[2]. The age of the gold mineralisation in southern Ethiopia can be bracketed between 650 and 500 Ma, based on ^{40}Ar-^{39}Ar dates on muscovite grains from the Lega Dembi gold deposit and from selected granitoids [1]. Analysis of the deformational history and the tectonothermal events suggests that the favourable structures that localise gold mineralisation are coeval with the D3-D4 deformational phases [1]. The lode-gold quartz

vein-type mineralisation represents a coherent group of epigenetic mineralisation formed during a broadly synchronous Pan-African hydrothermal event, (660 -500 Ma)[1], which has been modelled to identify areas of highest prospectivity.

References:

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