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Oxygen and Sulfur Isotope Composition of Gold Bearing Granite Gneiss and Quartz Veins of Megele Area, Western Ethiopia: Implication for Fluid Source

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Abstract : The Megele area gold-bearing Neoproterozoic rocks in the Western Ethiopian Shield has been under exploration for the last few decades. The geochemical and ore petrological characterization of the gold-bearing granite gneiss and associated quartz vein is crucial in understanding the gold's genesis. The present study concerns the ore petrological, geochemical, and stable O2 and S characterization of the gold-bearing granite gneiss and associated quartz vein. This area is known for its long history of placer gold mining. The presence of quartz veins of different generations and orientations, visible sulfide mineralization, and oxidation suggests that the Megele area is geologically fertile for mineralization. The Au and base metals analysis also indicate that Megele area rocks are characterized by Cu (2-22 ppm av. 7.83 ppm), Zn (2-53 ppm av. 29.33 ppm), Co (1-27 ppm av. 13.33 ppm), Ni (2-16 ppm av. 10 ppm), Pb (5-10 ppm av. 8.33 ppm), Au (1-5 ppb av. 2.11 ppb), Ag (0.5 ppm), As (5-12 ppm av. 7.83 ppm), Cd (0.5ppm), Li (0.5 ppm), Mo (1-4 ppm av. 1.6 ppm), Sc (5-13 ppm av. 9.3 ppm), and Tl (10 ppm). The oxygen isotope (δ18O) values of gold-bearing granite gneiss and associated quartz veins range from +8.6 to +11.5 ‰, suggesting the mixing of metamorphic water with magmatic water within the ore-forming fluid. The Sulfur isotope (δ34S) values of gold-bearing granite gneiss range from -1.92 to -0.45 ‰ (mean value of -1.13 ‰) indicating the narrow range of value. This suggests that the sulfides have been precipitated from the fluid system originating from a single source of the magmatic component under sulfur isotopic fractionation equilibrium condition. The tectonic setting of the host rocks, the occurrence of ore bodies, mineral assemblages of the host rocks and proposed ore-forming fluids of the Megele area gold prospects have similarities with features of orogenic gold deposit. The δ18O and δ34S isotopic values also suggested a metamorphic origin with the magmatic components. Thus, the Megele gold prospect could be related to an orogenic gold deposit related to metamorphism and associated intrusions.

Keywords : fluid source, gold mineralization, oxygen isotope, stable isotope, sulfur isotope
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