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G14
Obuasi: The World's Largest Precambrian Gold Deposit, Ghana, West Africa

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Obuasi, with a total Mineral Resource plus past production of approximately 70 Moz Au, is the largest Precambrian gold deposit and one of the very largest in the world. The orebody is dominated by a roughly equal mixture of paragenetically complex gold-bearing quartz veins, and altered (carbonate-muscovite-arsenopyrite-dominant), moderately to strongly deformed, variably graphitic phyllites and meta-greywackes. The steeply dipping lodes extend over an 8-km strike length and to depths of >2.5 km. Obuasi is hosted by ~2135 Ma siliciclastic rocks of the Eburnean Kumasi Basin, which were obliquely shortened along an inverted boundary with the older Eoeburnean Ashanti Belt to the east. Greenschist facies metamorphism (~350°C and 100-200 MPa) and related deformation with strong shear and veining components were coeval with mineralization and related alteration at ~2095 Ma. For this part of the deposit's 100-year research history, we combined relatively recent major regional geological framework analysis, underground and historical mapping, new cross sections, and early and revised 3D models with the drill-core database, and added a layer of interpreted litho-geochemistry and vein density from a portable XRF-gathered dataset, to expand our understanding of the gold endowment, distribution, and controls.

Any discussion of the origin of the Obuasi deposit needs to reflect not only on the giant size of Obuasi itself, but also the large endowment of the wider host fault system over its 400-km strike length (>100 Moz Au). No other regional-scale structure in West Africa, and very few others globally, have comparable gold endowments. Several aspects of the Obuasi deposit indicate that the accumulation of so much gold can be considered a product of the protracted history of deformation, inversion, dewatering, and metamorphism, with much fluid flow focussed regionally near an original major tectono-stratigraphic boundary. The mineralizing fluids were derived primarily from deeper, As-rich metasedimentary sources by basinal fluid expulsion and metamorphic devolatilization triggered by inversion and shortening, followed by transpression (Figure). Continued fluid injection and deformation during and after the metamorphic peak produced changes in gold fineness, sulfide assemblages, repeated dissolution (stylolites), and re-precipitation of mineralized veins, and a change from early deformed shear-related, sulfide-rich lodes to later quartz-rich lodes that plunge down or across the axes of younger transpressional folds. Channelized fluid flow due to reactivation of basin-edge transfer structures (inferred from mapping and geophysics), and/or irregularly distributed gold source rocks, may explain the variation in gold endowment along the former basin boundary.

The deposit, and its understanding, have significant implications for the orogenic gold model. As has been proposed by several authors in the last decade, any assessment of gold deposits that include substantial, poly-deformed metasedimentary rocks needs to consider early tectono-stratigraphic evolution (in particular basin and sub-basin edges and basement-influenced transfer structures) and the potential roles of basinal and early-metamorphic fluids–Obuasi being the prime example.

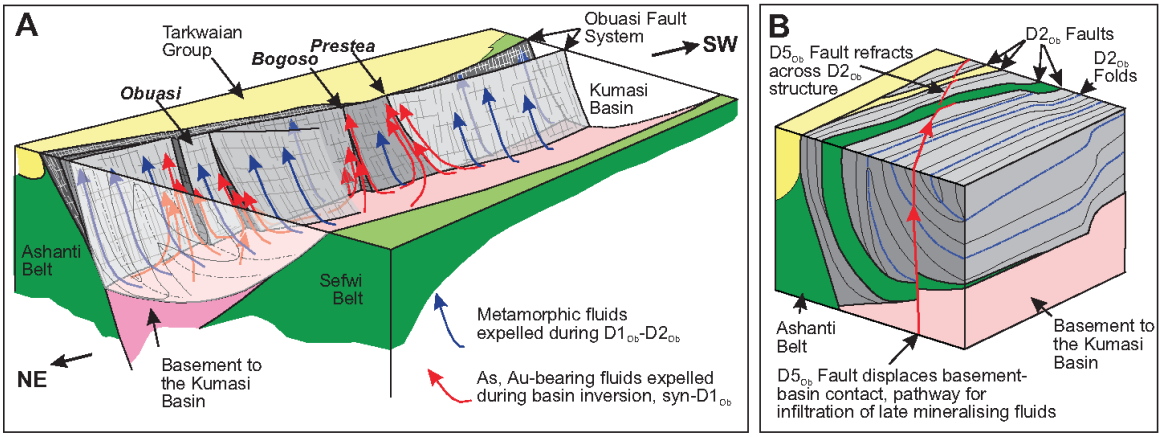
A
Tarkwaian Group
Bogoso
Prestea
Obuasi
Obuasi Fault System
SW
Kumasi Basin
Ashanti Belt
Sefwi Belt
NE
Basement to the Kumasi Basin
Metamorphic fluids expelled during D1Ob-D2Ob
As, Au-bearing fluids expelled during basin inversion, syn-D1Ob
B
D5Ob Fault refracts across D2Ob structure
D2Ob Faults
D2Ob Folds
Ashanti Belt
Basement to the Kumasi Basin
D5Ob Fault displaces basement-basin contact, pathway for infiltration of late mineralising fluids

Figure 10