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A Giant Gold System, Geita Greenstone Belt, Tanzania

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1 Introduction

Archean greenstone belts are a well-known source of gold deposits. If we ignore the giant Witwatersrand gold system we can confidently say that the majority of Archean gold comes from greenstone belts. Even though as a general rule greenstone belts are highly prospective for gold some greenstone belts have proved to be much more productive than others. For example most of the gold in Canada's Superior Province comes from Abitibi Greenstone Belt, particularly from Timmins area (e.g. Wyman, 2003). Similarly, most of the gold mined from Australia's Yilgarn Craton comes from the Kalgoorlie camp which accounts for more than half of the gold mined so far (Philips et al., 1996) in the entire craton. Interestingly, although far apart, the geology and mineralization styles of gold deposits in both areas are very much alike suggesting that the processes leading to the formation of giant ore systems must be similar starting from the ground preparation to the mineralization process. In the Tanzania Craton the giant Bulyanhulu gold deposit is also similar to the giant deposits found in the Timmins and Kalgoorlie areas, respectively. That is, lode gold mineralization style, mafic host rocks, ages, map scale patterns, deformation styles and the short pre-mineralization crustal history are all largely similar (e.g. Bateman and Bierlein, 2007). Bulyanhulu is much more similar to the Kalgoorlie camp in the sense that it consists of one major gold deposit, while the Timmins camp is made of a large number of smaller gold deposits. These similarities between three giant gold camps situated on three different continents may indicate that in order to form giant gold deposits certain conditions need to be satisfied. However, that is not always the case and the gold mineralization found in Geita Greenstone Belt does

not follow the typical pattern of Archean lode gold deposits. Geita Greenstone belt contains a minimum of fifteen gold deposits which may resemble the Timmins camp, but the mineralization style, alteration, structures and host rocks are different. The mineralization in Geita Greenstone belt is preferentially hosted within deformation zones developed along the contact of banded ironstones and porphyries of various compositions rather than along some major shear systems. The structures associated with the mineralised system are minor, the alteration zone is restricted to the mineralised zone, quartz veins are rare or missing although silicification is common.

2 Regional Geology

The northern half of the Tanzania Craton is formed by a series of NeoArchean granite greenstones belts (Kabete et al., 2012) with a poorly constrained stratigraphy and geological history. The stratigraphy of the Tanzanian Craton has been subdivided in three main units (e.g. Borg, 1994). The oldest unit called the Dodoman Supergroup is made up mainly of high grade metamorphic rocks (mafic and felsic granulite and gneiss) subordinate lower grade schist and thin slivers of greenstone (Kabete et al., 2012). The Nyanzian supergroup occurs stratigraphically above the Dodoman supergroup and its succession contains mafic volcanic units (amphibolite, pillow lava, minor gabbro) at the bottom followed by felsic volcanics and pyroclastics in the middle and banded ironstone, felsic volcanics and minor epiclastics to the top. The Nyanzian is unconformably overlain by the Kavirondian Supergroup which consists mainly of coarse grained conglomerate, grit and quartzite.

Geita Greenstone Belt is an approximately E-W trending greenstone belt located in the north-western part of the Tanzania Craton and south of Lake Victoria. To the

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north, east and west the greenstone was intruded by late 2660 to 2620 Ma syn- to post-tectonic granite, while to the south it comes in contact with gneiss and mylonitic granitoids along a steeply dipping, mostly E-W trending shear zone. The general stratigraphy consists of a lower mafic unit overlain by tuffaceous sediments and epiclastics intercalated with chert and ironstone units. The supracrustal package was intruded by porphyry dikes of diorite to dacite composition. The entire sequence is multiply deformed and the metamorphic grade is mainly greenschist facies except along the southern margin where amphibolite facies assemblages are common.

3 Geita Greenstone Belt gold deposits

The gold deposits in Geita Greenstone Belt occur in three NW-SE trending domains: the Kukuluma domain to the NE, the Nyamullilima domain to the SW and the Central domain in the central part.

The Kukuluma domain contains five major gold deposits distributed along an approximately E-W mineralised trend. These are from east to west: Area 3 South, Area 3 Central, Area 3 West, Kukuluma and Matandani. The mineralization is steeply dipping along the contacts of intermediate fine grained intrusions and magnetite rich chert and ironstone showing a general en-echelon, left stepping geometry. The gold is associated with secondary pyrite, arsenopyrite and minor pyrrhotite. Magnetite, silica, carbonate and amphibole alteration are variably present within the mineralised zone.

The central domain contains seven major gold deposits with the three largest ones occurring along a NE-SW mineralised trend. These are from north east to south west: Geita Hill, Lone Cone and Nyankanga. The other three deposits occur singly: Chipaka in the centre of the greenstone belt, Pit 30, Mgusu and Saragurwa along an NW-SE trending ironstone ridge. Geita Hill, Lone Cone and Nyankanga occur along a moderately NW dipping

system of reverse faults that have been multiply reactivated during subsequent deformation events. The mineralization is mainly related to diorite- ironstone contacts exploited by the shear system. The alteration is restricted within the ore zone and consists of secondary sulphide (mainly pyrite), silica, carbonate and moderate potassic alteration.

The Nyamullilima domain contains three major gold deposits on an approximately NW-SE mineralised trend. These are from SE to NW: Ridge 8, Star and Comet and Roberts. Individual deposits occur along a series of N-S trending, steeply dipping, left stepping en-echelon fault zones that cut across the ironstone-rich sediments and granite-granodiorite-tonalite intrusions. Mineralization is preferentially localised along fault zones where they cut the ironstone-granitoid contacts. The mineralization is associated with secondary pyrite and minor pyrrhotite, silica, carbonate and actinolite alteration.

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