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The Niassa Gold Belt, northern Mozambique – A segment of a continental-scale Pan-African gold-bearing structure?

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ABSTRACT

The Niassa Gold Belt, in northernmost Mozambique, is hosted in the Txitonga Group, a Neoproterozoic rift sequence overlying Paleoproterozoic crust of the Congo–Tanzania Craton and deformed during the Pan-African Orogeny. The Txitonga Group is made up of greenschist-facies greywacke and schist and is characterized by bimodal, mainly mafic, magmatism. A zircon U–Pb age for a felsic volcanite dates deposition of the sequence at 714 ± 17 Ma. Gold is mined artisanally from alluvial deposits and primary chalcopyrite-pyrite-bearing quartz veins containing up to 19 ppm Au have been analyzed. In the Cagurué and M'Papa gold fields, dominantly N–S trending quartz veins, hosted in metagabbro and schist, are regarded as tension gashes related to regional strike-slip NE–SW-trending Pan-African shear zones. These gold deposits have been classified as mesozonal and metamorphic in origin. Re–Os isotopic data on sulfides suggest two periods of gold deposition for the Cagurué Gold Field. A coarse-crystalline pyrite–chalcopyrite assemblage yields an imprecise Pan-African age of 483 ± 72 Ma, dating deposition of the quartz veins. Remobilization of early-formed sulfides, particularly chalcopyrite, took place at 112 ± 14 Ma, during Lower Cretaceous Gondwana dispersal. The ~483 Ma assemblage yields a chondritic initial $^{187}Os/^{188}Os$ ratio of 0.123 ± 0.058. This implies a juvenile source for the ore fluids, possibly involving the hosting Neoproterozoic metagabbro. The Niassa Gold Belt is situated at the eastern end of a SW–NE trending continental-scale lineament defined by the Mwembeshi Shear Zone and the southern end of a NW–SE trending lineament defined by the Rukwa Shear Zone. We offer a review of gold deposits in Zambia and Tanzania associated with these polyphase lineaments and speculate on their interrelation.

1. Introduction

The Niassa Gold Belt (NGB) is the most important gold district in northern Mozambique. Despite this, it is a lack of written work from the NGB, apart from a number of unpublished reports. Artisanal mining of alluvial and primary gold in quartz veins has been carried out since 1990 along Lago Niassa in northernmost Mozambique (Figs. 1 and 2). The estimated total annual gold production in the belt is around 5 t/year (Lächelt, 2004). Gold fields were visited during a national mapping program in northern Mozambique (Norconsult, 2007). The aims were to characterize the gold mineralization and to relate metallogenesis to the regional geological and tectonic evolution. This paper summarizes results from regional geological and structural mapping, geochemical characterization and U–Pb geochronology of the host rocks, and the Re–Os geochronology and isotope geochemistry of sulfides from one of the gold fields. The data provide a framework for the larger scale geological and tectonic context of the Niassa Gold Belt, and identify a continental-scale structure favorable to gold mineralization in central-southern Africa.

2. The Txitonga Group

The Niassa Gold Belt is hosted in the Txitonga Group (Norconsult, 2007), formerly called the Cobué Group (Pinna et al. 1993; Lächelt, 2004). The reason for the name change is that the village Cobué is situated outside the area underlain by the rocks of this unit; the new name is after a prominent mountain peak central to the type area. The Txitonga Group is exposed in a rugged, high mountainous area, extending from the Tanzanian border in the north to south of Cobué, over an area between 10 and 25 km wide and nearly 100 km long. In the west, it overlies the Paleoproterozoic Ponta Messuli Complex (Bingen et al., 2006) along a southeast dipping tectonic contact (Fig. 2). In the east, it is faulted against Permo-Jurassic sedimentary rocks in the Maniamba Graben that are correlated with the Karoo Supergroup (Verniers et al, 1989). Rocks of the Txitonga Group are strongly deformed along

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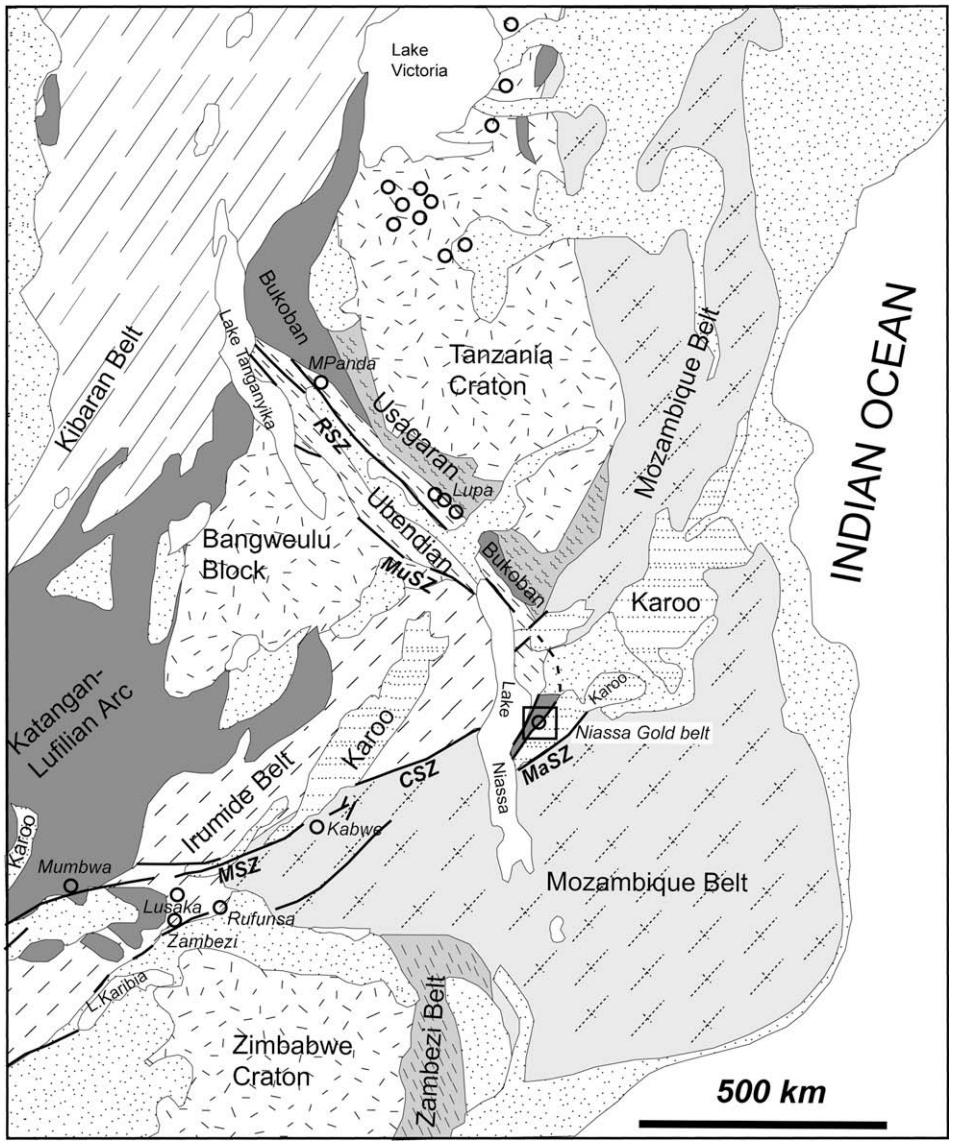

Fig. 1. Location of the Niassa Gold Belt in a regional geological and tectonic setting (Fig. 2 is marked by a square). Also shown are major gold deposits associated with the proposed mega-scale Mwembeshi–Rukwa Shear structure. (MSZ – Mwembeshi Shear Zone, CSZ – Chimaliro Shear Zone, RSZ – Rukwa Shear Zone, MuSZ – Mugesse Shear Zone, MaSZ – Macaloge Shear Zone). The main tectonic units in eastern Zambia, northern Malawi, northern Mozambique and southern Tanzania are also shown. The map is modified from the International Metallogenic Map of Africa (CGMW/CGS 2002).

both contacts, and commonly form mylonites. This is demonstrated east of the Cagurué Gold Field where NE–SW-trending mylonites are exposed just above the flat plain occupied by the Karoo sedimentary rocks. The Unango and Marrupa Complexes to the east of the Karoo Supergroup (Fig. 2) comprise mainly Mesoproterozoic granulites and orthogneisses, respectively of granitic composition.

The Txitonga Group is dominated by metasedimentary rocks, which can be divided into two major units, here called the M'Popo and the Issango Formations (Fig. 2). *The M'Popo Formation* comprises the eastern part of the group. With a general strike NE–SW and a dip of 30–70° to the NW, it is structurally the lowest unit and probably also the lowest in stratigraphy. The formation consists mainly of mica (±chlorite) schist, interlayered with arkosic to arenitic metasandstones. The schist is often gradational into metagraywacke. In thin-section the schist is seen to be dominated by very fine-grained sericite, light green chlorite and quartz. The sericite partly forms pseudomorphs after feldspar, and also occurs in small veinlets crosscutting the regional foliation. The sandstones vary from arkosic with quite coarse feldspar clasts to arenitic with clasts of schist, greenstone and quartz. They are quite commonly also calcareous.

The Issango Formation makes up the western part of the Txitonga Group and is probably the highest unit in stratigraphy. It consists mainly of quartz–mica schist and metagraywacke to arkosic metasandstone, but contains abundant thin layers of quartzite. The contact to the underlying Paleoproterozoic Ponta Messuli Complex is observed close to Lago Niassa, where extremely deformed and folded metagraywacke in the Issango Formation occurs up to 50 m away from the contact. The contact is clearly tectonic and is interpreted as a thrust (Norconsult, 2007). The metagraywacke is fine- to more coarse-grained with shards and laths of chlorite and biotite and aggregates and grains of quartz in a fine-crystalline sericitic matrix. Rhythmically banded to laminated metasandstones with feldspar clasts are at places interbedded with the metagraywacke (e.g. close to Cobué on Lago Niassa).

Several thin horizons (tens of meters thick) of banded iron formation (BIF) are reported in the northeastern part of the