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Geological setting and timing of the cassiterite vein type mineralization of the Kalima area (Maniema, Democratic Republic of Congo)

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ABSTRACT

The Central African Mesoproterozoic Karagwe-Ankole belt in the Great Lakes area (DRCongo, Rwanda, Burundi, Uganda and Tanzania) forms a metallogenic province that hosts a variety of granite-related mineralization, which contains cassiterite, columbite-tantalite, wolframite/ferberite, spodumene and beryl. The Kalima area in the Maniema province of the DRCongo forms one of the most important areas for cassiterite mineralization in the eastern part of the DRCongo, even after many decades of exploitation. The mineralization dominantly consists of quartz veins that are hosted in Mesoproterozoic metasediments at the contact with granitic rocks of the Kalima granite (Avuanga and Yubuli) or directly cross-cutting these granitic rocks (Atondo). Only limited – and mainly unmineralized pegmatites – have been described in the Lutshurukuru area. Mineralized quartz veins – and some granite bodies – intruded following the regional tectonic foliation or existing fracture zones, confirming the late-to post-tectonic origin of the fertile granite system. The emplacement of the quartz veins resulted in an alteration of the metasedimentary and granitic host-rocks, mainly resulting in muscovitization, tourmalinization and silicification. Cassiterite itself formed relatively late during vein formation and is associated with muscovite in fractures in or along the margins of the quartz veins.

^{40}Ar-^{39}Ar age dating of muscovite of an unmineralized pegmatite from the Lutshurukuru area gave an excellent plateau age of 1024 ± 5.5 Ma, while the muscovite associated with mineralization gave plateau ages of 986 ± 5.3 Ma for the Atondo deposit and 992.4 ± 5.4 Ma for the Yubuli deposit. The rather large spread in ages between the supposed parental granite/pegmatite and quartz veins is interpreted to reflect different magmatic events in the evolution of a composite granite system, starting at ~1020 Ma and ending with mineralized quartz vein formation at ~990 Ma. The latter age corresponds with the U–Pb age reported for columbite-tantalite in the area (993 ± 1 Ma at Kamisuku), which could be interpreted as the primary formation age of a new generation of mineralized pegmatites in the Kalima area, or as the resetting age of the U–Pb system during the ~990 Ma mineralizing event. Muscovite of a mineralized greisen sample of Avuanga gave a plateau age with relaxed constraints of 1010.3 ± 5.9 Ma, which has been interpreted as a partially resetting of muscovite formed at ~1020 Ma age, during the ~990 Ma event.

1. Introduction

The Kalima area is located in the Central African Karagwe-Ankole belt, which forms together with the Kibara belt a Mesoproterozoic geological structure (Tack et al., 2010). This structure extends from the southern part of the Katanga province in the Democratic Republic of Congo (DRCongo) to the southwestern part of Uganda (Fig. 1; Cahen et al., 1984). The two belts are separated by a Palaeoproterozoic basement rise that represents the NW extension across Lake Tanganyika of the Ubende belt (SW Tanzania). The

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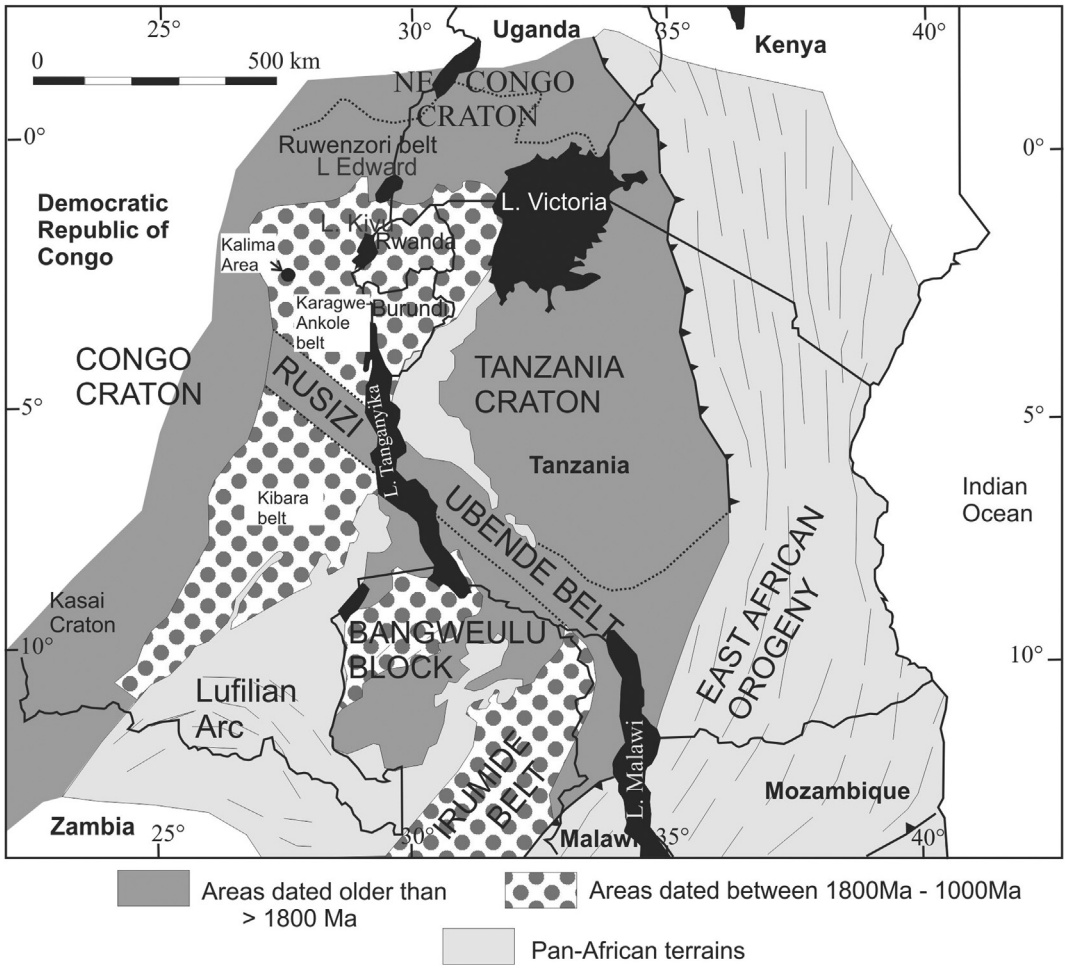

Fig. 1. Regional tectonic setting of the Kibara belt (KIB) and the Karagwe-Ankole belt (KAB) in Central Africa (modified after Brinckmann et al., 2001), with indication of the Kalima area.

Karagwe – Ankole belt (KAB) comprises Rwanda, Burundi, SW Uganda, northwestern Tanzania and the Kivu – Maniema provinces in the DRCongo, while the Kibara belt (KIB) is located in the Katanga province in the southwest of the DRC (Tack et al., 2010; Fernandez-Alonso et al., 2012). The Karagwe-Ankole belt forms a belt of Palaeo- and Mesoproterozoic supracrustal units, that consists mainly of metasedimentary and –volcanic rocks, which are intruded by voluminous S-type granitic rocks and subordinate (ultra-)mafic bodies (Cahen et al., 1984; Tack et al., 2010). The Karagwe-Ankole and Kibara belts host a large number of granite-related ore deposits, with the typical Sn–W–Nb–Ta metal association. The metals are dominantly hosted in pegmatites or quartz veins (e.g. Dewaele et al., 2011; Pohl et al., 2013). Pegmatites can be found mineralized with Nb–Ta minerals, cassiterite, amblygonite, spodumene, beryl, etc., while mineralized quartz veins mainly contain cassiterite or wolframite. During the last decade, renewed metallogenetic research on the Sn, W and Nb–Ta mineralization in the KAB and KIB has resulted in new insights in the formation of the granite related mineralization in the Great Lakes area (e.g. Pohl, 1994; Pohl and Günther, 1991; Pohl et al., 2013; Dewaele et al., 2011; Goldmann et al., 2013; Hulsbosch et al., 2013, 2014; Lehmann et al., 2014; Melcher et al., 2015).

The Kalima area is situated in the western part of the Maniema province of the DRCongo (Fig. 2) and is mainly characterized by cassiterite mineralized quartz veins that can either occur at the contact of the granites and metasediments or in the granitic rocks (Varlamoff, 1948, 1950; 1954, 1956). Numerous mineralized zones have been exploited in the larger Kalima area for mainly cassiterite and some wolframite. Superficial weathering at depths of more than 50 m resulted in eluvial deposits that have been exploited by hydraulic mining by the company Symétain/Sominki (Unpublished mining archives RMCA, Royal Museum for Central Africa). An organized exploitation of the mineral deposits started in the Kivu-Maniema area from 1923 onwards. By the end of 1994, a total production of the Kivu-Maniema region of 390.000 tons of cassiterite, 10.000 tons of wolframite, 7.700 tons of columbite-tantalite, 2.300 tons of monazite, 6.000 tons of beryl has been reported (Unpublished mining archives RMCA). Non-specified resource potential of 10.000 tons of cassiterite has been proposed in the last annual report of Sominki of 1984 (unpublished archives, RMCA). No numbers are reported for the remaining columbite-tantalite, tungsten, beryl and gold potential.

Geological studies on deposits in the Maniema area are rather rare and date mainly from Belgian colonial periods (Varlamoff, 1948, 1950, 1954; 1956; Steenstra, 1967). In this study, we focus on the geology and the timing of the formation of the primary cassiterite mineralization of the Kalima area. This study of the geology of the Kalima area is largely based on unpublished geological