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FULL LENGTH ARTICLE

Structure roles for the localization of metasomatite uranium deposit type at Wadi Belih area, Northern Eastern Desert, Egypt

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Abstract Wadi (W.) Belih area is one of the most important uranium occurrences in the northern parts of Eastern Desert of Egypt. The major mineralizations are structurally controlled especially along the contact between the Hammamat sedimentary rocks and younger granites record a complex history of deformations where, the uranium mineralization are located along a footwall of shear zone striking ENE–WSW to NE–SW direction. This shear zone was reactivated during its tectonic history starting from compression trending NW–SE and NE–SW respectively to younger extensional event trending NW–SE.

Due to the resulting younger extension NW–SE event the hydrothermal solution gradually migrates upward forming alkali metasomatite, contemporaneous with uranium mineralization. They are developed along that shear zone where structure contact and the low-stress regions in the vicinity of the shear zone are favorable locations for fluid flow focusing and hence U mineralizations occur in the highly fractured and mylonitized zones along the contact as lensoidal bodies.

1. Introduction

Based on the geological setting of the deposit (IAEA) classification, uranium deposits world-wide are grouped into 14 major categories of deposit types (Fig. 1). The authors suggests that W. Belih uranium mineralizations along the contact between Hammamat sediments and granites could be fitted within the metasomatite uranium deposit categories; where metasomatite uranium deposits occur in association with structurally-deformed rocks that were already altered by metasomatic processes, usually associated with the introduction of sodium into these rocks [1,2]. Uranium mineralization is contemporaneous with the metasomatism of the host rocks and the mineralization is structurally controlled with faults providing a focused pathway for fluid migration with mineralization concentrated along and adjacent to faults [4]. All the above mentioned criteria of the metasomatite uranium deposit type are detected in W. Belih area. Major examples of this type include Espinharas deposit (Brazil) and the Zheltye Vody deposit (Ukraine) and other similar types of U deposits are

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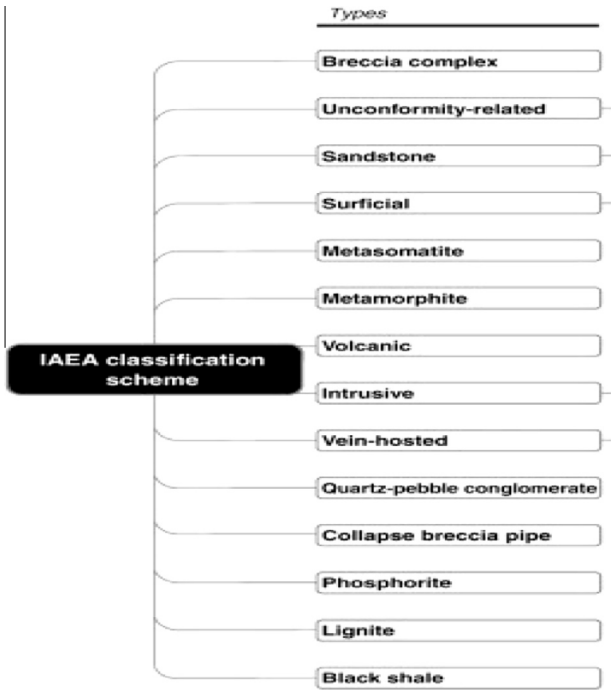

Figure 1 IAEA classification scheme of uranium ore deposits (after [3]).

known all over the world (Fig. 2). In the present work, W. Belih area near Gabal (G.) Gattar could be the Egyptian example.

The mineralizations are best hosted in the Hammamat sediments along the structure contact with sheared Gattar granites. Some mineralizations may, however, occur in the sheared granites itself [6–9,10].

The uranium mineralizations at the contact zone between G. Gattar and the Hammamat sedimentary rocks along W. Belih was investigated by [11]. He concluded that the uranium mineralization is essentially controlled by a local reverse fault trending ENE–WSW and dips 45–65° to the SSE.

X-ray diffraction technique was used by [12,13] to identify some secondary uranium minerals for the uranium mineralizations at part of the studied area and they mentioned the presence of uranophane and tyuyamunite as secondary uranium minerals.

Both granites and Hammamat sediments, at W. Belih, are enriched in U, Y, W, Nb, Cu, Pb, Sb and Zn elements, but with higher magnitude for the Hammamat [14].

The supergene meteoric water and super-heated solutions could pass through the structural network. They leached some of the magmatic U from the younger granites and reprecipitated their loads, in the shear and weak zones of the Hammamat sediments, by the effect of evaporation and adsorption on the surface of Fe oxides and clay minerals [15].

Detailed subsurface studies of the mineralized faults and fractures were carried out in mine located in the investigated area. These studies revealed that the presence of a major subsurface uranium mineralized trends recorded in the main adit and the drift of that mine. It takes essentially the ENE–WSW and NE–SW trends [16].

There is about twenty three uranium occurrences in G. Gattar granites, most of them are located near the granites – Hammamat sediments contact and very few are hosted in the Hammamat sediments [17].

In this paper, structural analysis along the uranium mineralized shear zone in the structural contact between Hammamat and granites are used to constrain the timing of deformation and fluid circulations to clarify the relationship between tectonic activity and uranium mineralizations.

2. Field geology

The investigated area is bounded by Latitudes 27°6′ and 27°7′ N and Longitudes 33°15′ and 33°18′ E (Fig. 3). The nearest

Figure 2 World distribution of uranium deposits associated with Na-metasomatism. The dark gray zones correspond to Archean to Early Paleoproterozoic rocks (after [5]).