Arabian Journal of Geosciences (2021) 14:1344
https://doi.org/10.1007/s12517-021-07490-9

S. I. GEOLOGY OF AFRICA

High resolution mapping of alteration zones in Daghbag and Bakriya gold occurrences (Central Eastern Desert, Egypt) using field, mineralogical-geochemical, and remote sensing data

Wael Hagag[1] · Amr Abdelnasser[1]

Received: 26 April 2021 / Accepted: 31 May 2021

Abstract
Daghbag and Bakriya gold occurrences are located at the western part of the central Eastern Desert of Egypt belonging to Barramiya gold district. This work presents comprehensive geological, structural, and new mineralogical data to define the different alteration types related to the gold mineralization at these occurrences. Moreover, in order to reduce the field and additional costs, ASTER and Landsat-8 OLI data are used at the initial exploration stages to elucidate the spread of alteration zones associated with the auriferous quartz veins at the Daghbag and Bakriya gold mines. Two alteration types are defined in the studied areas: type 1 (sericitic/muscovitization) and type 2 (propylitic). The Daghbag gold mineralization is mainly related to NW- milky, brownish, and smoky quartz veins and veinlets having pyrite, chalcopyrite goethite and malachite with gold. While Bakriya gold mineralization occurs within NNW–SSE and NW–SE quartz veins and alteration zones at the mining areas including pyrite and chalcopyrite, magnetite, hematite, malachite, and goethite with gold. Mass balance calculations and Gresens'isocon diagrams revealed that Au was added with Cu along mainly with K_2O, Fe_2O_3, MgO, CaO to the sericitic and some propylitic with ferriginated altered wallrocks. Although alteration types do not show regular distribution pattern, several band combinations, and multiplications, developed selective principal component analysis and image transformations were developed for detecting the hydrothermal alteration zones associated with gold mineralization using ASTER and Landsat-8 OLI data. In which, the gold mineralization at the studied area is related to pervasive sericitic (±muscovite) alteration types with some propylitic and ferrugination at Bakriya mine areas.

Keywords Hydrothermal alteration · Gold mineralization · ASTER · Landsat-8 OLI · Daghbag · Bakriya · Central Eastern Desert (Egypt)

Introduction

In the metallogenic provinces, the remote sensing satellite imagery nowadays enhances and increases the accuracy of detecting the lithological units, geological structures, and different hydrothermal alteration zones associated with several mineralization types. Moreover, the application of multisensor satellite imagery during the preliminary stages of mineral exploration looks to be a useful tool in alteration mineral mapping in the areas of gold mineralization (Rowan et al. 2000; Ranjbar et al. 2004; Zoheir et al. 2019). The hydrothermal alteration minerals with identifying spectral absorption properties are finding out by hyperspectral and multispectral remote sensing data in the regions of visible and near-infrared (VNIR) and through the shortwave infrared (SWIR) areas (Bedini 2011; Pour and Hashim 2011; Pour and Hashim 2013). Therefore, the satellite imagery processing utilizes the spectral signatures of Fe-oxides, OH-bearing minerals, and carbonate for delineating the different hydrothermal alteration haloes within the hydrothermal ore deposits (Abdelnasser et al. 2018). The different image processing techniques such as true and false Color Composites (FCC), Band Ratioing (BR), and Principal Component Analysis (PCA) assisted the

This article is part of the Topical Collection on *New Advances and Research Results on the Geology of Africa*

✉ Wael Hagag
wael.hagag@fsc.bu.edu.eg

Amr Abdelnasser
amr.khalil@fsc.bu.edu.eg

[1] Geology Department, Faulty of Science, Benha University, Benha 13518, Egypt

Published online: 07 July 2021