

Abstract

Porphyry copper and epithermal deposits are spatially linked to hydrothermal fluid systems causing zoned alterations of host rocks and the formation of mineralized deposits. These zoned alterations affecting the host rocks can be associated with a mineralization which placed them amongst the first useful clues to be looked for when mining exploration is undertaken. It's because of its emplacement between the Moroccan Haut-Atlas and Anti-Atlas, over the formations marking the end of the pan African orogeny, that the Tidili sector was selected to be the target of a prospection campaign achieved by Moroccan National Office of Hydrocarbons and Mines (ONHYM). These formations are the product of a magmatism linked to a post-collisional to extensional tectonism which can be propitious to the emplacement of a mineralization related to porphyry copper and epithermal systems (Richards, 2011). Following a hyperspectral airborne campaign, the Tidili sector revealed that in some places alteration minerals were occurring as zonations in certain turfs. This study focuses on one of the places where alteration was spotted nearby the village of Aoudid that is referred to here as the Aoudid sector. This altered sector is close ($\approx 100\text{m}$) to the Eç-çour sector where quartz veins containing Au and Cu mineralizations were identified by the ONHYM. Thus, the present work concentrates on the study of these alteration areas spotted by the hyperspectral analyses, the volcanic host rocks and their possible connection. The dating and geochemical analyses performed on the host rocks placed them at the end of the Neoproterozoic between 546.3 ± 3.5 for the oldest and 540.0 ± 1.7 for the youngest in a setting of post collisional to extensional tectonism linked with the emplacement of subaerial flow domes. A zoning pattern in the alterations was recognized in the Aoudid sector which was correlated with a multispectral analysis. The presence of multiple breccias, amongst which one is of phreatomagmatic component, was confirmed. Moreover, the alteration in the Aoudid sector consists of a zonation close to the contact between the phreatomagmatic breccia and the andesites' formations which evolve from an association of quartz and pyrophyllite nearby the contact to a quartz-sericite, dickite-kaolinite and chlorite sericite assemblages respectively. These zonations and assemblages can be linked to a high-sulfidation epithermal system. An oxidized mineralization consisting of iron oxides linked to the diverse alterations and quartz veins was observed in the sector, which suggests the past presence of a hydrothermal activity related to a mineralization. The obtained results throughout the present study tie in with the existence, in the Aoudid sector, of a high-sulfidation epithermal system related to a late-Ediacaran volcanic episode. The presence of a such mineralized episode at the Precambrian-Cambrian boundary in the Aoudid sector, complements the list, quite large already, of these episodes amongst the formations that have occurred during the pan African orogeny in the Moroccan Anti-Atlas.