Aeromagnetic modeling of Precambrian subsurface structures of the Tasiast area, NW Mauritania : Mining consequences

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The NW sector of Mauritania represents the Archean province of the Reguibat Ridge. It is mainly composed of the typical Archaean cratonic association of granitoid gneisses, greenstones belts and granites. The greenstone belts contain high mineral potential, mainly gold. This is particularly the case of the Chami Greenstone Belt, which hosts the large Tasiast gold mine whose gold deposits are hosted along a NS oriented shear zone with a surface of 70 x 15 km^2.

The mineral-bearing bodies of Tasiast are presented in both forms of (i) veins of quartz-carbonate-white feldspar-pyrrhotite-pyrite, veinlets of quartz-carbonated containing gold, and (ii) adjacent gold disseminated and hosted within rocks from greenschist to amphibolite facies, banded iron formations (BIF) with magnetite-quartzite, and adjacent volcano-clastic rocks. The whole of these mineralizations follow a series of reactivated thrust faults, including Tasiast and Piment fracture zones (Heron et al., 2016). At the northern end of the Chami Greenstone Belt, Piment mineralizations are hosted within BIF, felsic volcanic rocks, and associated clastic rocks, while in its western branch, they are hosted within mafic rocks (Sedore and Masterman, 2012; Heron et al., 2016). The clay alteration and the high salinity of fluid inclusions indicate possible orogenetic gold deposits dated between 1.85 Ga and 1.5 Ga (Higashihara et al., 2004; Marutani et al., 2005).

Thanks to the available aeromagnetic data recorded at 100 m elevation northern Chami area, suitable computations on the anomaly map reduced to the pole were used to propose a subsurface structural model. In fact, upward continuations, apparent magnetic susceptibility, directional derivatives, analytical signal, 3D Euler deconvolution and spectral analyses were investigated to build this model (Thompson, 1982; Blakely and Simpson, 1986; Reid et al., 1990; Cowan and Cowan, 1993; Blakely, 1996; Mushayandebvu et al., 2001; Roest et al., 1992). They helped decipher the main evidenced structural features with the main NNE-SSW, NW-SE and ~N120° directions, identified on most all computed maps combined with in situ measurements. They probably correspond to mafic dykes, faults and shears rooted up to 5 km depth, particularly to the North, SW and NE, and southwards and westwards by spectral analyses and 3D Euler deconvolution, respectively (Fig. 1). The basement is deeper towards the West and South and outcrops towards the NE in agreement with the geological observations. In addition, the high values of magnetic susceptibility (χ_m) measured in situ on BIF (25.7-35.10^{-3} SI) south of Akjoujt could be at the origin of metallotects sources associated with magnetic minerals for gold bearing and base metals exploration.

Keywords: dykes, shears, Precambrian, modelling, aeromagnetism, subsurface structures, gold mines

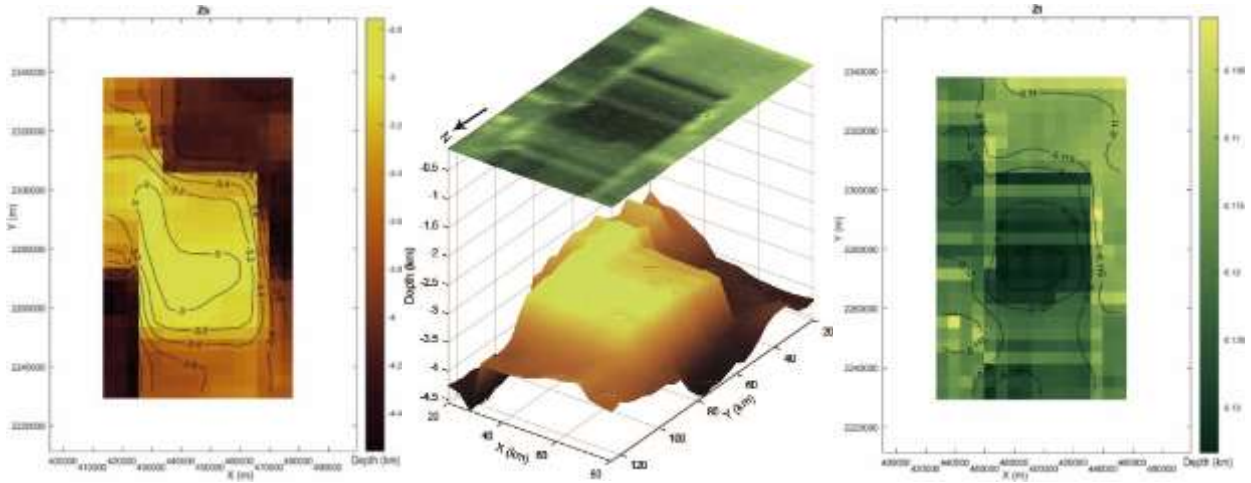

Fig. 1. Projection of 3D solutions of the spectral analysis (Okubo et al., 1985 ; Tanaka et al., 1999) showing the base (Zb : "bottom") and top (Zt : "top") geometries on the left (right) side (isocontours, km), respectively. The scales of the depths are given in km.

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