

## 3D structural cartography based on magnetic and gravity data inversion – Case of South-West Algeria



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### ABSTRACT

This article presents the results of 3D aeromagnetic and gravity data inversion across the West African Craton (WAC) in South West Algeria. Although the used data have different origins and resolutions, the performed manual and automatic interpretation for each dataset shows a good correlation with some earlier geological studies of the region, major structural aspects of the locality, as well as other new structural features. Many curved faults parallel to the suture zone indicate the presence of terranes or the metacratonization of the WAC and a related fault network of great importance with NE–SW and NW–SE directions. The mega shear zones from north to south, which are visible at the surface in the Hoggar, are also observed along the Saharan Platform. The fact that these faults are observed since the Cambro-Ordovician in all crust (including the Saharan Basins) indicates that this area, which is situated on the border of the WAC, remained active during the entire period of time.

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### 1. Introduction

In this article the primarily objective is to obtain a 3D image of magnetic and gravity anomaly sources distributions in the north-eastern part of the WAC border in South-West Algeria and its neighboring regions. This is very challenging since this region is known for its geological complexity.

Many sedimentary basins in this area, such as Reggane, Ahnet, Sbaa, Timimoune and Tindouf, are known for their hydrocarbon inhibition. Along with the appearance of minerals many diamond indices were found along the WAC border in the southwest of the region (Allekk and Hamoudi, 2008) also some gold mines (e.g. Tirek and Amesmassa) are present in the southeast of the region which formed at the eastern Ouzzalian fault (Marignac et al., 1996).

Only a few geophysical studies using potential field methods with a regional scale have been conducted in South and South West Algeria:

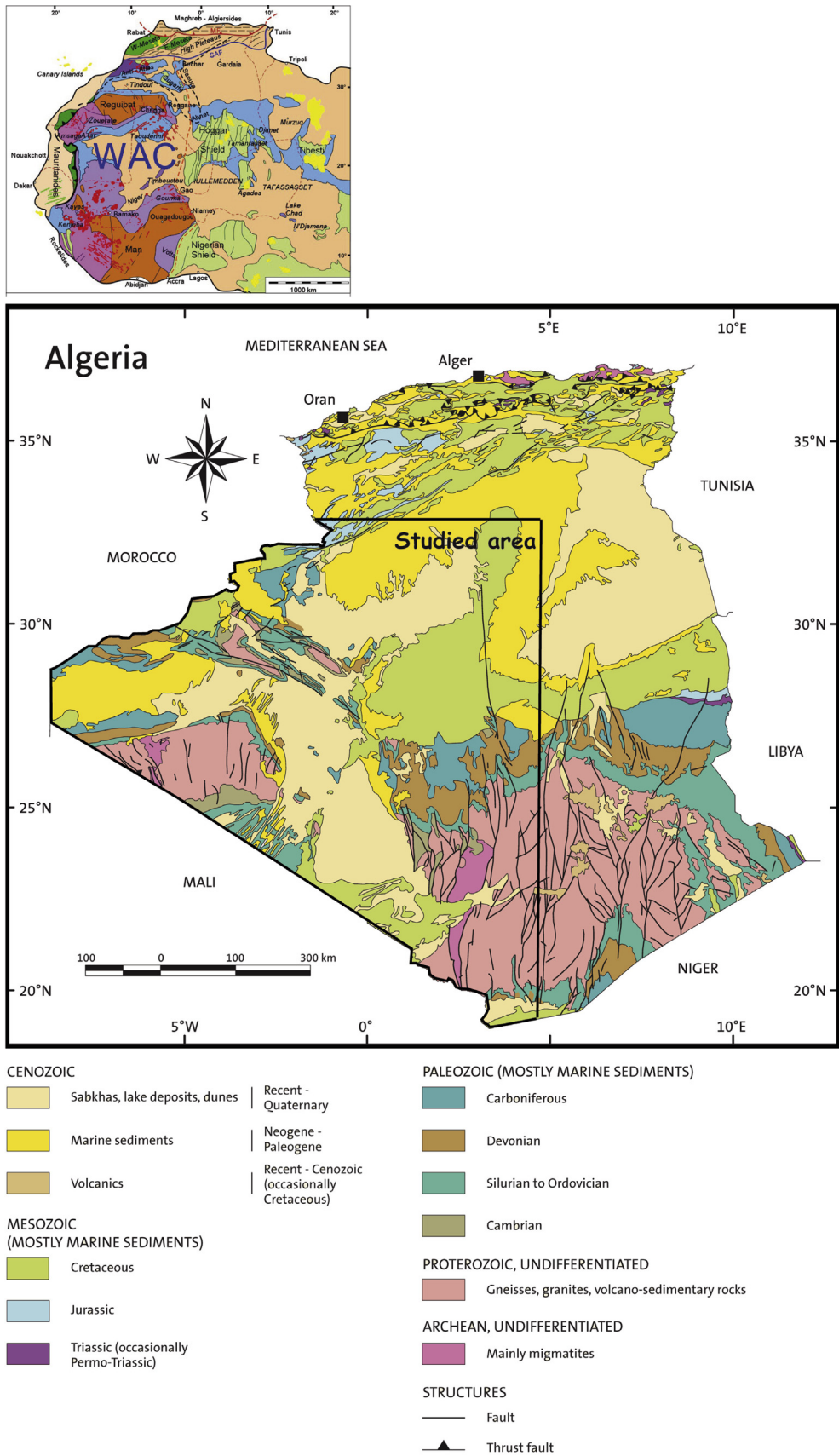
- Using gravity data Bayer and Lesquer (1978) and later Lesquer and Louis (1982) localized the WAC border between the western part of the Hoggar and the Tanezrouft which is reflected by an alignment of positive anomalies on the Bouguer Anomaly (BA) map.
- A regional interpretation and analysis of aeromagnetic data of the Tindouf basin and the Eglab region was performed by Allekk and Hamoudi (2008) to deduce the structures in order to predict potential diamond deposits.
- Based on land gravity data Takherist (1990) mapped the major structures and lineaments in southern Algeria. One of his most important results was the proposition that the Panafrican Suture Zone, which was localized earlier at the western Hoggar border by Bayer and Lesquer (1978) and Lesquer and Louis (1982), continues further to the northwest.

We note that all previous geophysical studies of the region of interest were based on only one kind of potential field data; either on gravity or on magnetic data. The present study, for the first time, tried to combine both types of data to enable better 3D inversion imaging.

A 3D algorithm, developed and described by Priezzhev (2005,

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**Fig. 1.** (a) (above) Position of WAC in Africa (Fabre, 2005; Liégeois et al., 2005; Ennih and Liégeois, 2008). (b) (below) Geological overview of Algeria (modified after Fabre et al., 1978 in geological atlas of Africa, Schlüter, 2006).

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