3D GRAVITY INVERSION OF CALA MINE (OSSA-MORENA ZONE, SPAIN)

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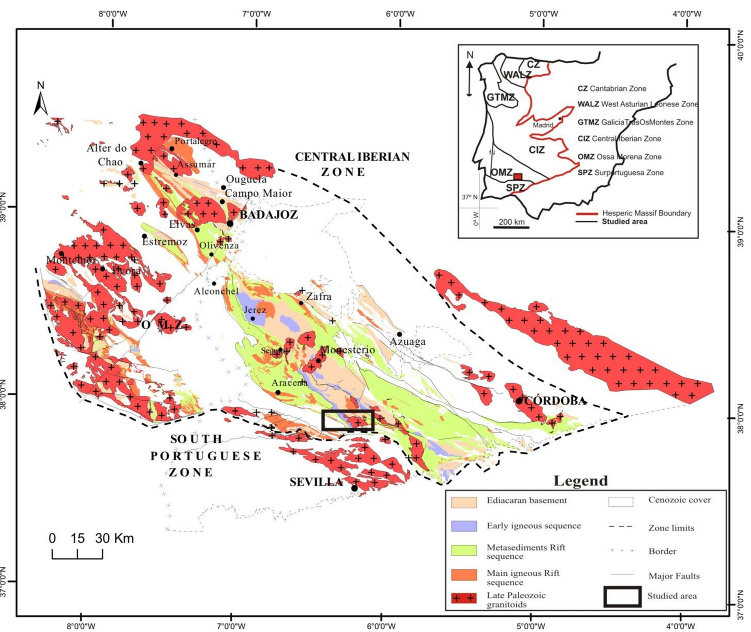
INTRODUCTION

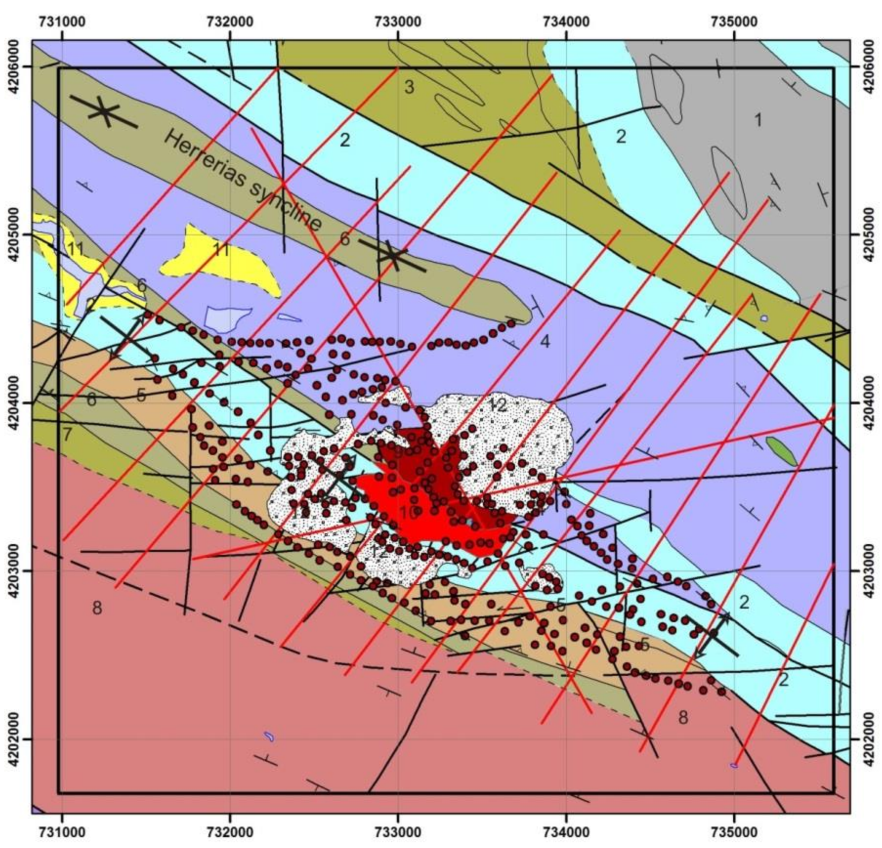


The Cala Mine area is located in the southern segment of the **Iberian Massif** that forms the pre-Mesozoic basement in most of the Iberian Peninsula and constitutes the westernmost extent of the European Variscan orogeny. More precisely, it is situated in the south-western limb of the Monesterio Antiform, within the **Ossa-Morena Zone** (OMZ), next to a granitic stock (*Cala* granite) that crops out with an oval geometry of c. 800x400 m. Cala granite is limited by an intrusive contact with the Cambrian Upper Detrital Formation (UDF) and a NW-SE thrust on top of the mineralized zone.

The mineralization consists in layered and irregular shaped bodies of magnetite, separated from each other by skarn zones.

The aim of the work is to **build a 3D model of Cala ore deposits to improve the knowledge of the geometry, physical properties and reserve estimation of the orebody from geological modelling and gravity inversion**. To achieve this we have improved the previous geological mapping, we have constructed 14 geological cross sections and we have built a 3D geological model. Moreover, a gravity survey and sampling have been carried out to study the petrophysics of all geological units. The 3D geological modelling has been refined first by forward modelling and, finally, by 3D gravity inversion.

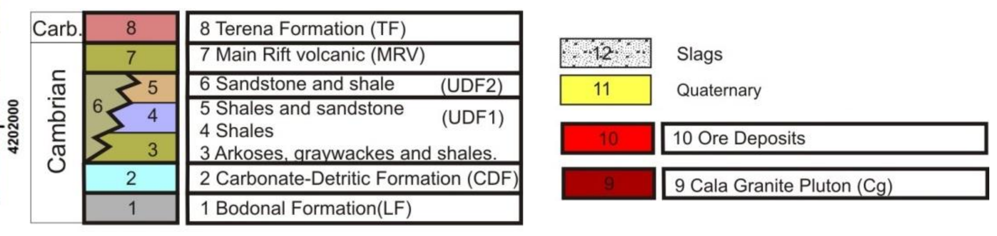
GEOLOGY



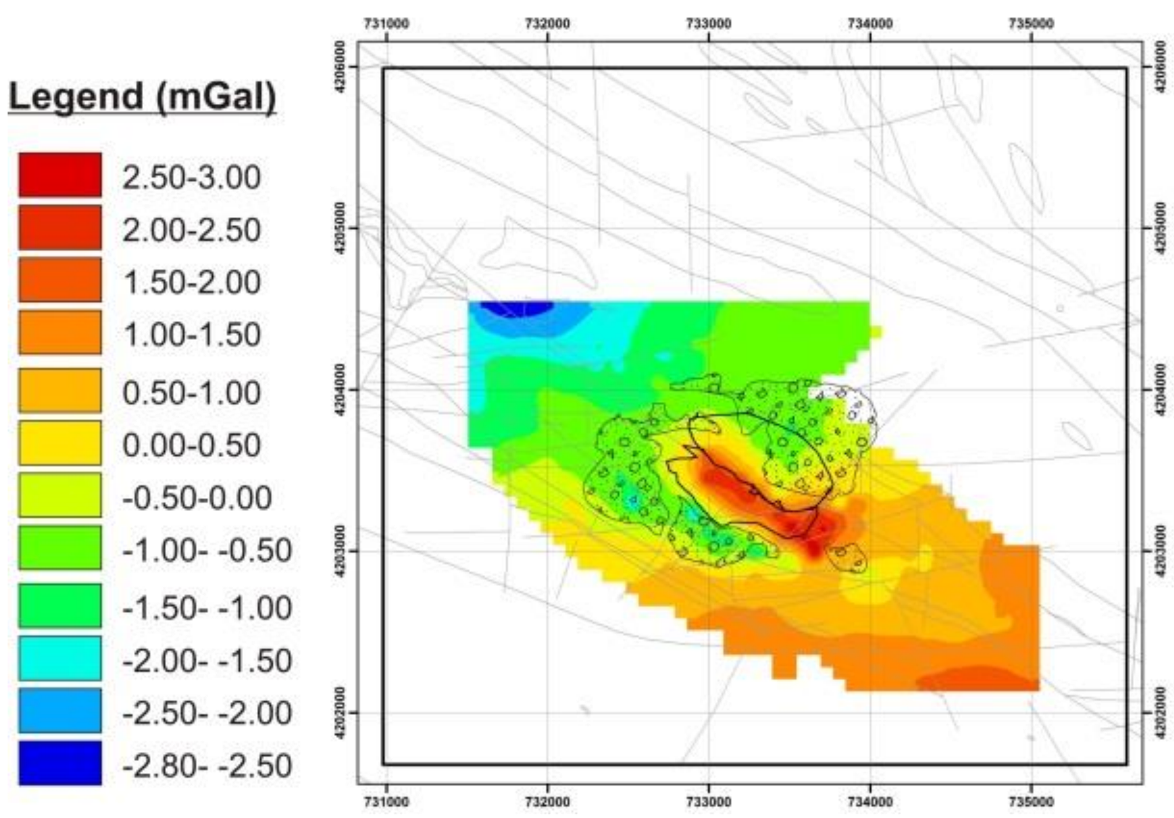
The 3D geological model has been carried out in an area of about 20 km^2 centered on the mine. The source data used has been topography, geological cartography and newly acquired gravity data specifically for this work (brown points) .

For the modelling, the lithology units of the geological map have been grouped. From bottom to top: Bodonal Group (LF); Carbonate Detrital Formation (CDF), which hosts the mineralization; Upper Detrital Formation (UDF) divided into two series (UDF1 and UDF2); Main Rift Volcanic (MRV); Terena Fm; Ore bodies replacing the skarn rocks and showing a wedge-like geometry, thinning in depth (CDF_Skarn-Orebody); and Cala granite (Cg).

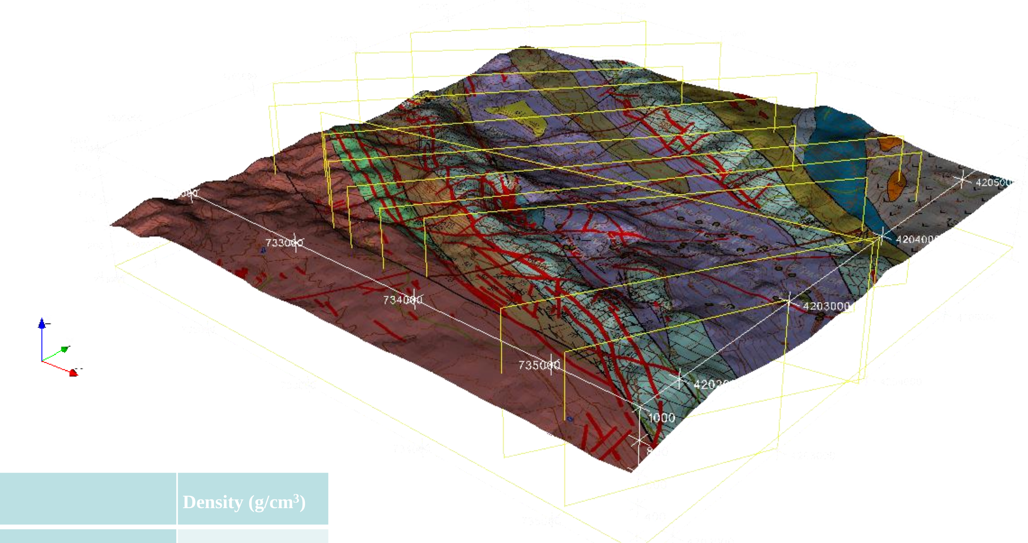
Legend



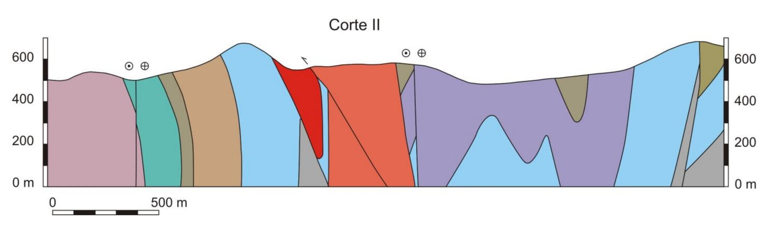
SOURCE DATA



Observed residual Bouguer anomaly

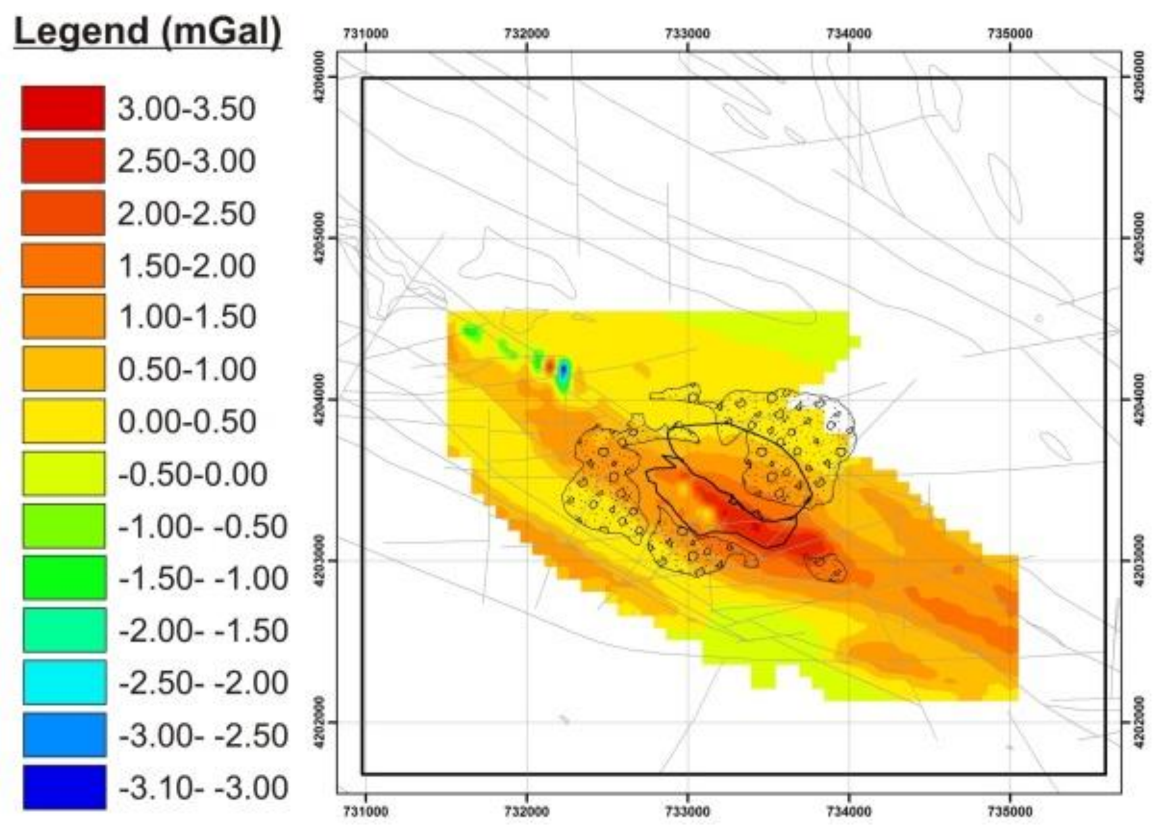


	Density (g/cm³)
Sampled units	avg
LF	2.56
CDF	2.73
UDF1	2.58
UDF2	2.58
MRV	2.80
CDF_Skarn-Orebody	3.06
Terena Fm (TF)	2.56
CALA pluton (Cg)	2.66

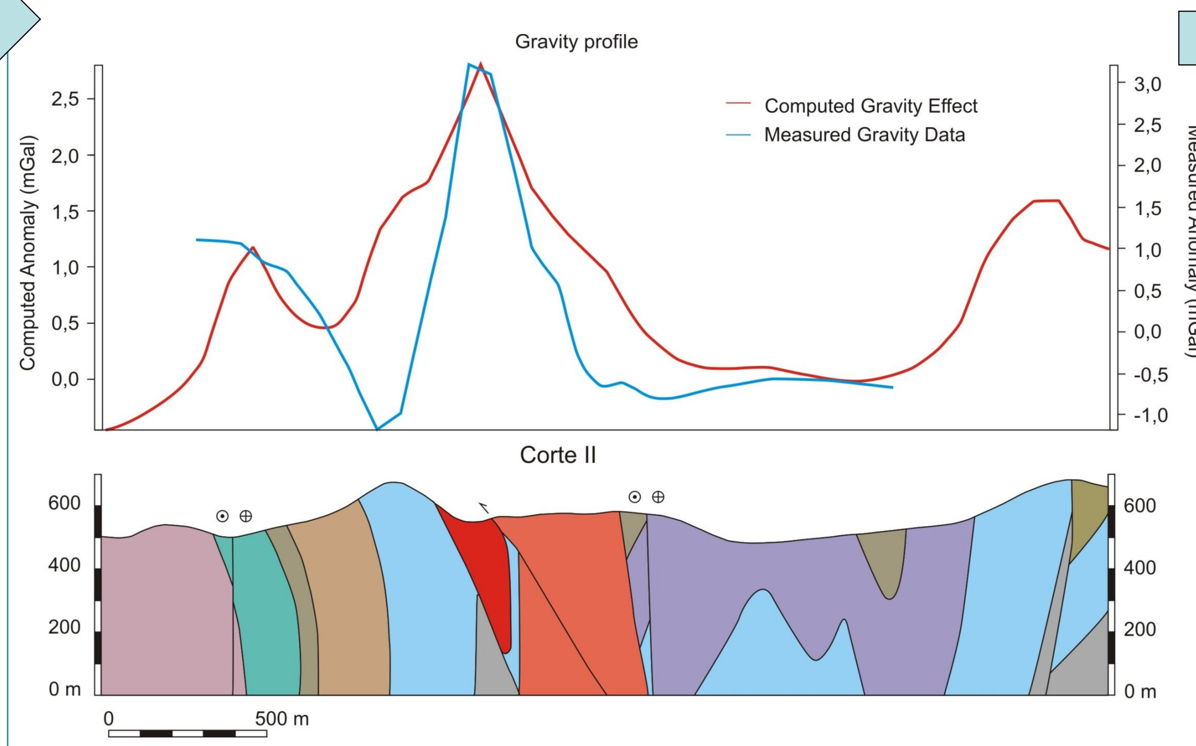


Densities for the different lithologies (Table above) are the same as the ones from the petrophysics used in the 2.5 D regional calculations (García-Crespo et al., this congress), being the only exception the mineralized zone and the skarn. A value of 3.06 g/cm^3 instead of the 3.48 g/cm^3 have been used in these last lithologies in order to keep the calculated central maximum with similar amplitude as the observed one.
Once build up the initial geological model, it was calculated its gravimetric response by forward modelling.

FORWARD MODELLING

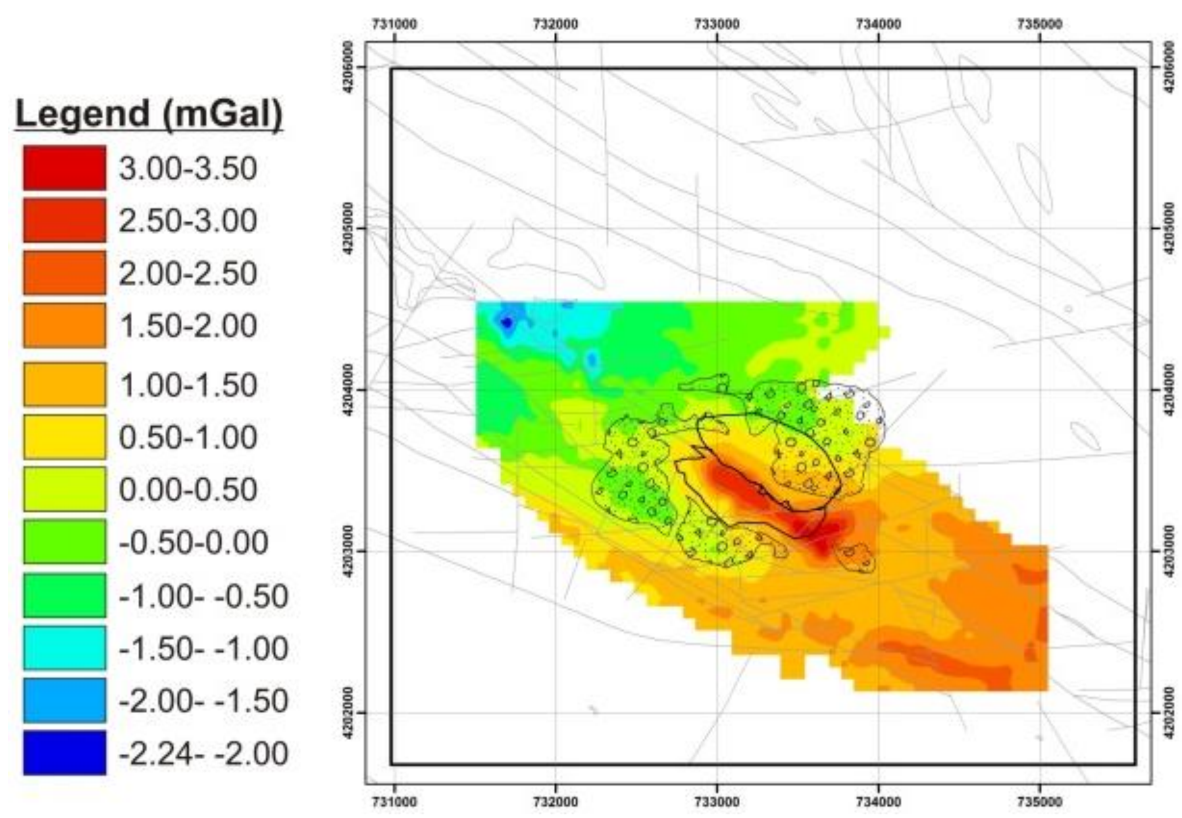


Calculated residual Bouguer from forward modelling

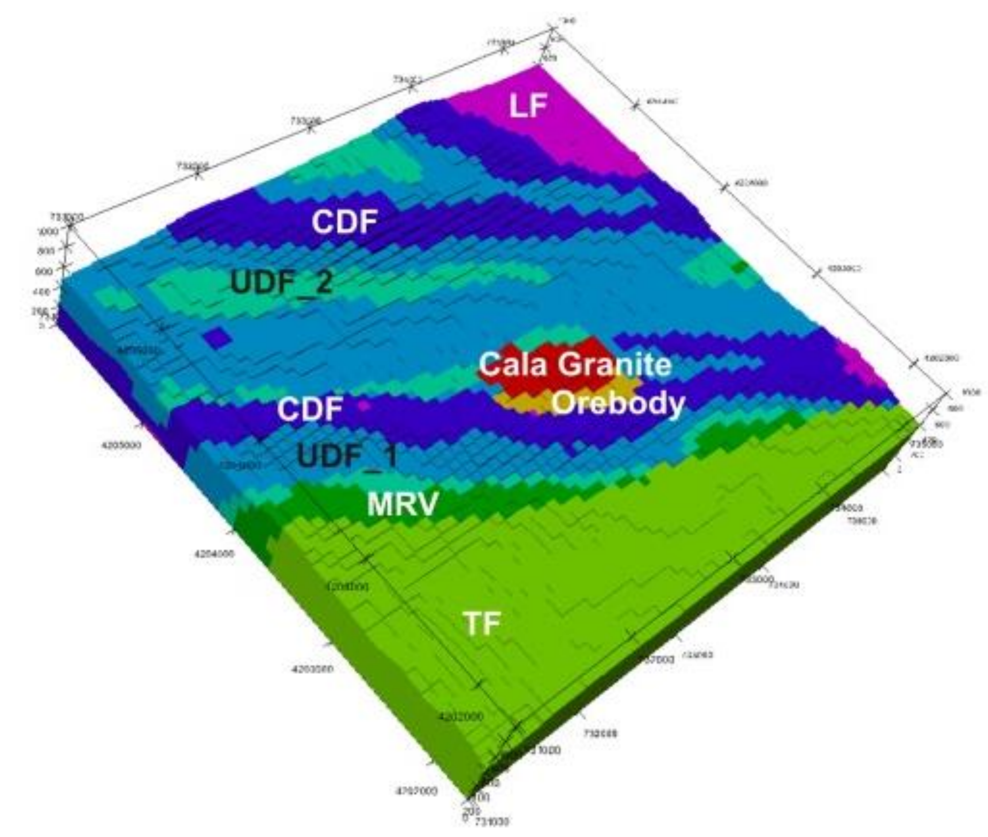


The calculated residual anomaly presents values ranging between -3.0 and 3.08 mGal. The lack of the NW-SE positive gradient and the strong positive anomalies due to the CDF and MRV units are the main differences in the observed residual. After small changes in the initial model and once the patterns of the calculated anomalies were very close to the observed, we have proceeded with the stochastic inversion.

3D GRAVITY INVERSION



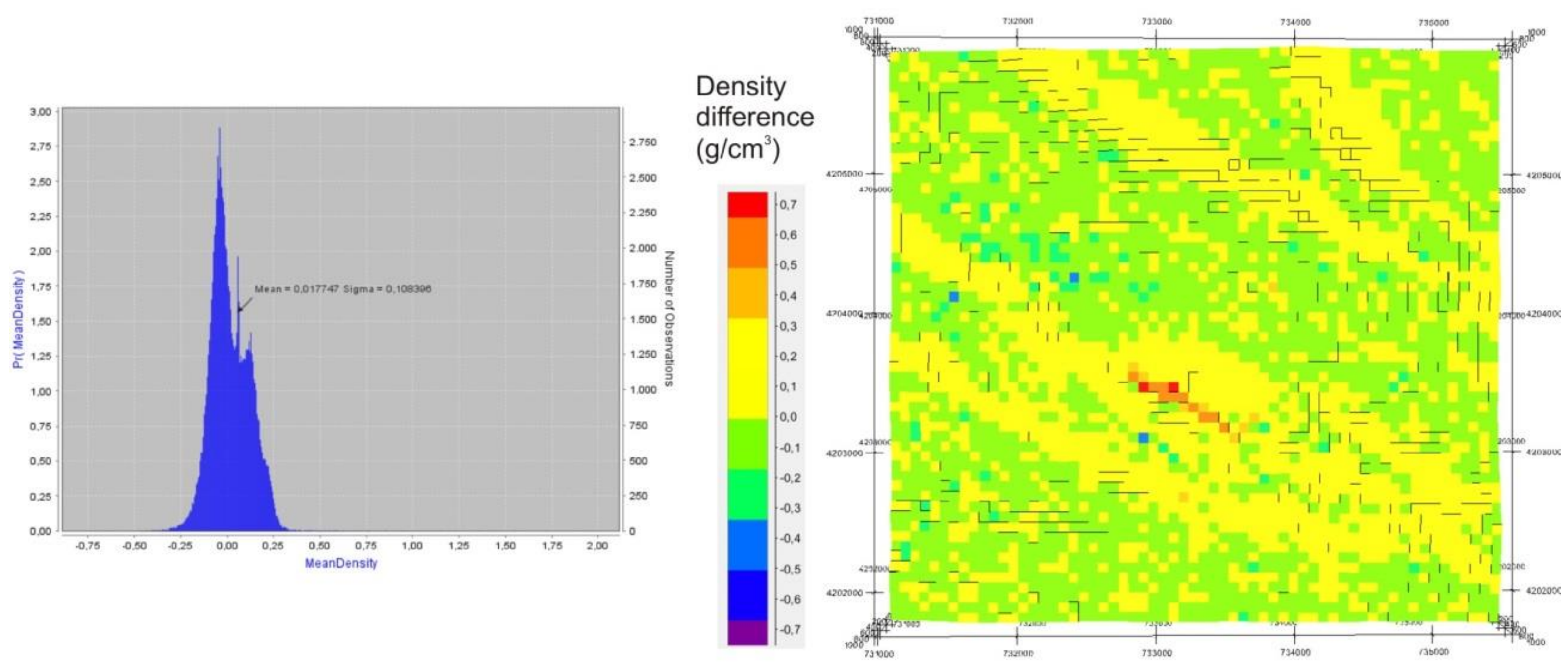
Calculated residual anomaly from the inversion



The calculated residual anomaly from the inversion presents range of the anomalies is -2.24 to 3.48 mGal. The pattern of these anomalies (direction, intensity and range) is very similar to the observed ones. The mineralization is well delimited by the central maximum and the positive NW-SE gradient together with the NE-SW interruptions of the anomaly, corresponding to the faulting. They are alike to the one depicted in the observed residual Bouguer.

RESULTS

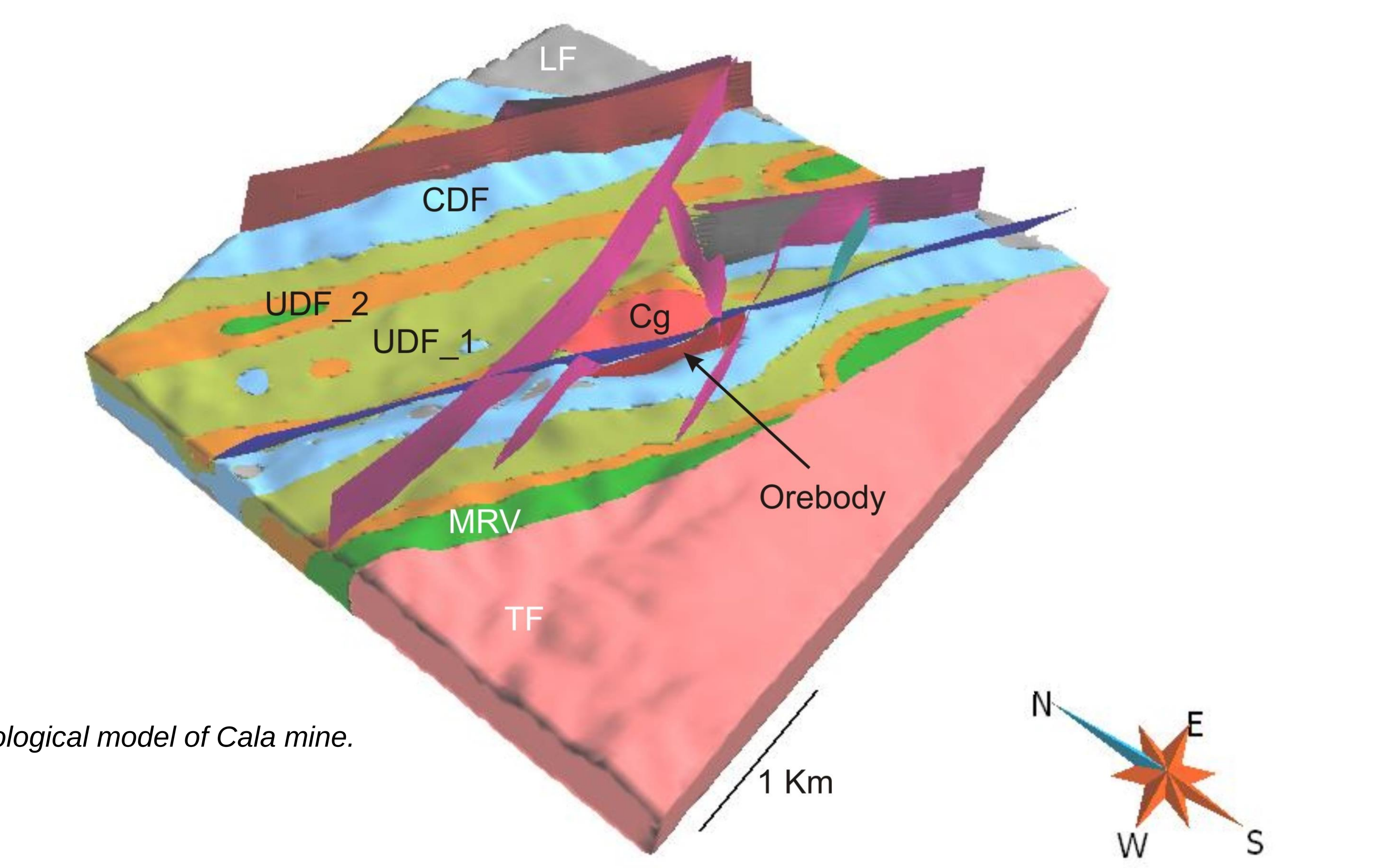
DENSITY



Differences between the densities from the petrophysical data and the ones obtained after the inversion.

The average variation for the densities is very small, 0.02 g/cm^3 with a SD of 0.1 g/cm^3. In the mineralization zone, the density after the inversion has increased by 0.4 g/cm^3, resulting in a calculated density for the ore bodies of 3.48 g/cm^3. In the SE area, the results show a general increase in the UDF and CDF formations between 0.1 and 0.3 g/cm^3.

MODEL



3D gOcad geological model of Cala mine.

In the geological model obtained from the inversion, the mineralization geometry keeps its bottom at c. 200 m at the central and SE zones whereas to the NW becomes shallower than in the starting model. Towards to the NW, the MRV completely disappears within unit 4; thickness of UDF2 decreases whereas thickness of UDF1 increases and the CDF units appears to be deeper.
The volume of the unit 9 (skarn and the ore body) calculated from the final model is about 43 Mm^3.Using as reference the density obtained from the inversion, 3.48 g/cm^3, the approximate weight for this unit is 150 Mt. From this quantity, 75-60 Mt correspond to the ore body.

ACKNOWLEDGEMENTS
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