SANTA OLALLA DE CALA AREA, 3D MODELLING. NEW INSIGHTS INTO THE CALA REGION

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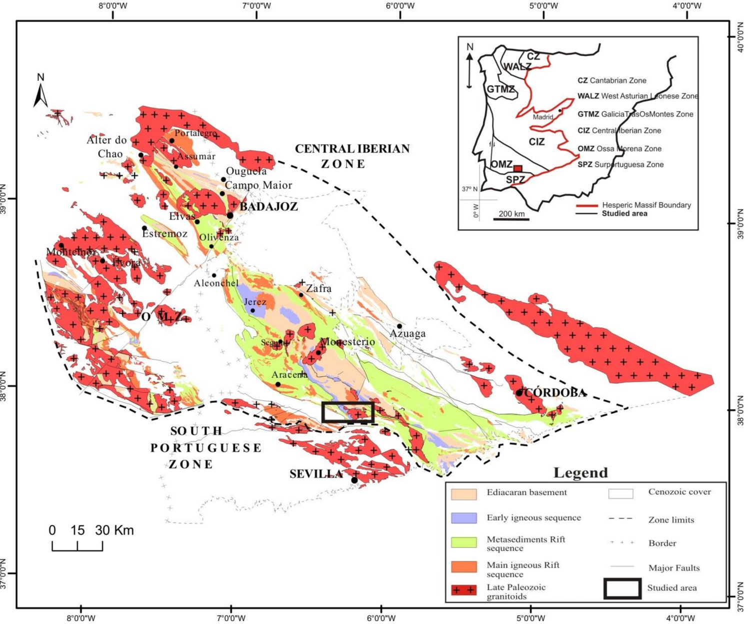
8th EUropean Congress on REgional GEOscientific Cartography and Information Systems
Geological 3D Modelling and Soils: functions and threats

Barcelona (Spain)
June- 2015

INTRODUCTION

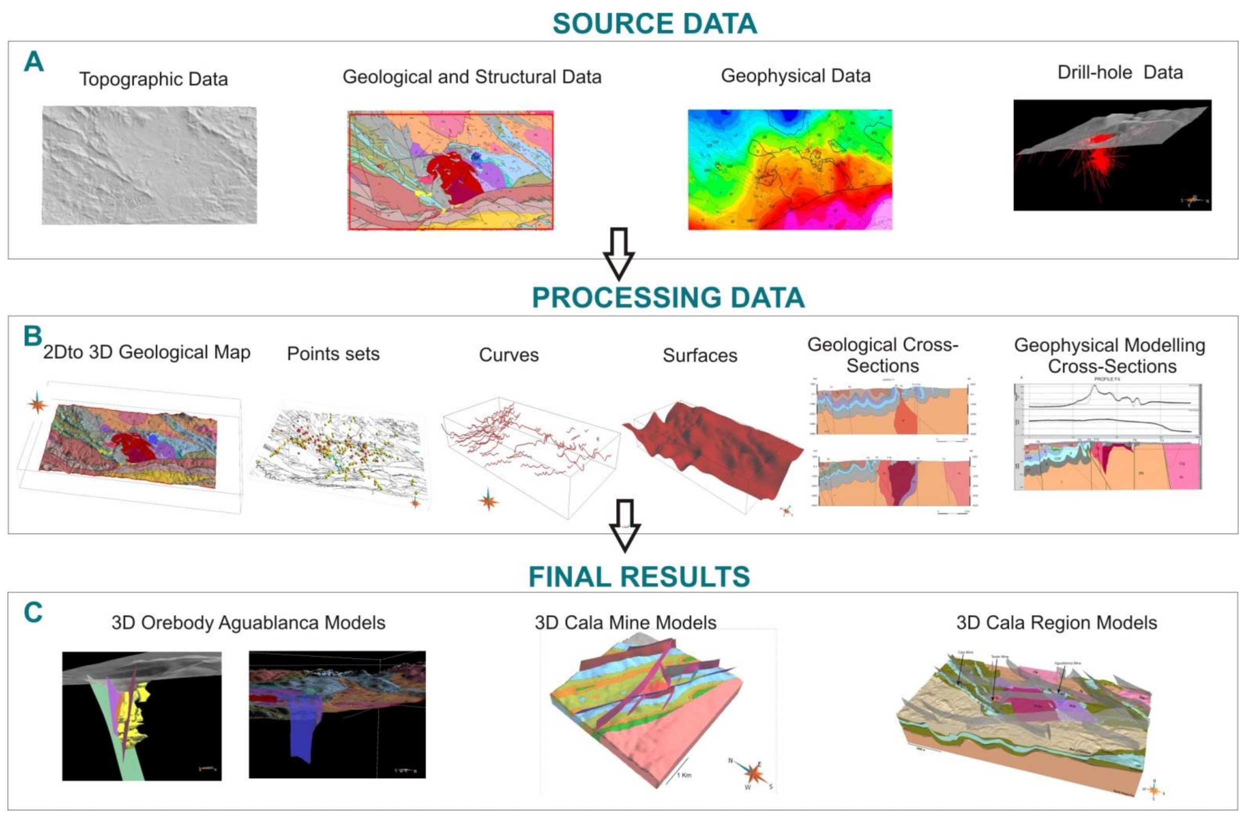


The Santa Olalla de Cala area is located in the southern segment of the **Iberian Massif** that forms the pre-Mesozoic basement in most of the Iberian Peninsula and constitutes the westernmost extent of the European Variscan orogeny. More precisely, it is situated in the south-western limb of the Monesterio Antiform, within the **Ossa-Morena Zone** (OMZ), which exposes a polyphase and poly-orogenic record with a complex history.

The current structure of the OMZ is mainly due to the **Variscan orogeny**. This study is focused in Variscan plutons that were emplaced in Late Proterozoic and Paleozoic sediments. Igneous and metamorphic activity of Variscan Orogeny led to the formation of various types of mineralization. In this paper two of these are included: the iron oxide replacement and skarn in the Cala mine and the Ni-(Cu-PGE) in mafic to ultramafic intrusion of Aguablanca Pluton.

The **aim** of this work is to **build a 3D model of Santa Olalla de Cala region**. To achieve this, we have improved the previous geological mapping and have carried out a regional gravity survey. Then, we have constructed a 3D geological model, at regional scale, that includes these two previous mineralizations. The Cala mine model can be seen in Mediato el al. (this Congress).

WORKFLOW

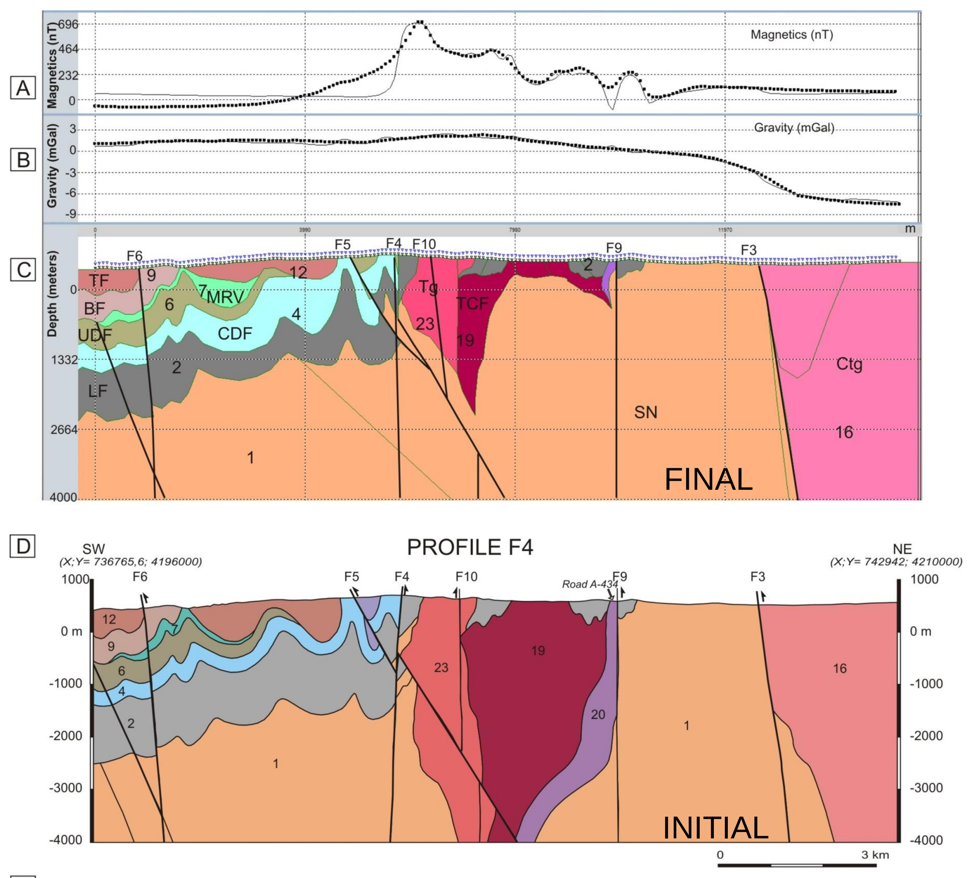


The **source data** used has been topography, geological cartography and geophysical data: magnetic and radiometric airborne data with gravity and petrophysical data from the IGME databases, and newly acquired gravity and petrophysical data specifically for this work

Processing data has been done using several software (ArcGIS, goCad, Geosoft). All horizons and pluton surfaces have been created by interpolation of the lines on the cross section using DSI (Discrete Smooth Interpolator) and establishing constraints to those lines.

The **final result** has been built in goCad for obtaining a geological 3D model. This includes the 8 intrusive bodies, two of them related to the mineral masses.

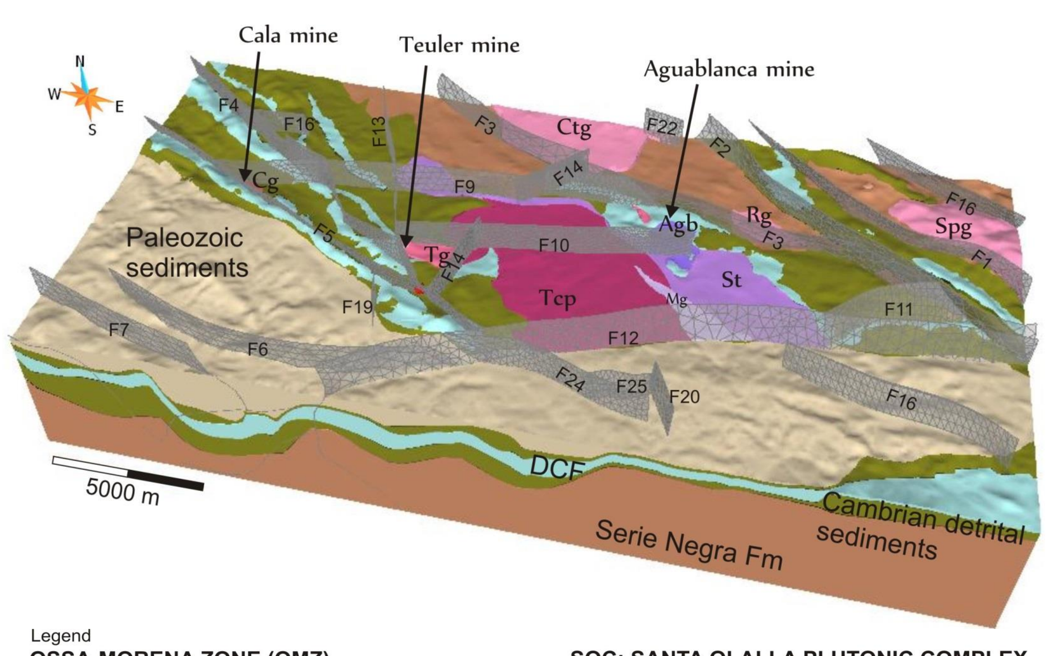
PROCESSED DATA

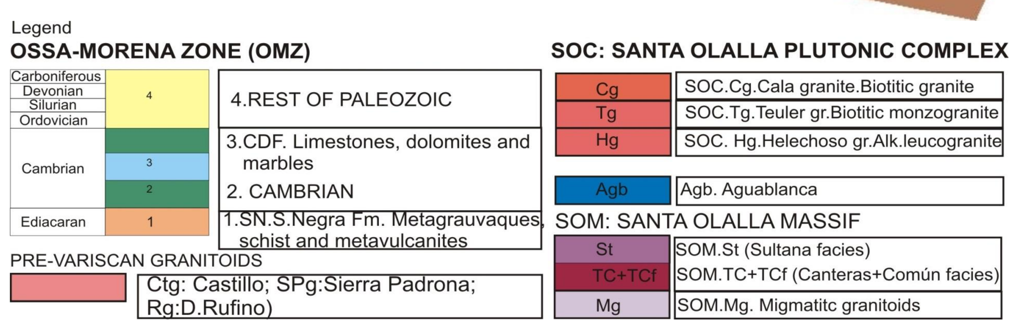


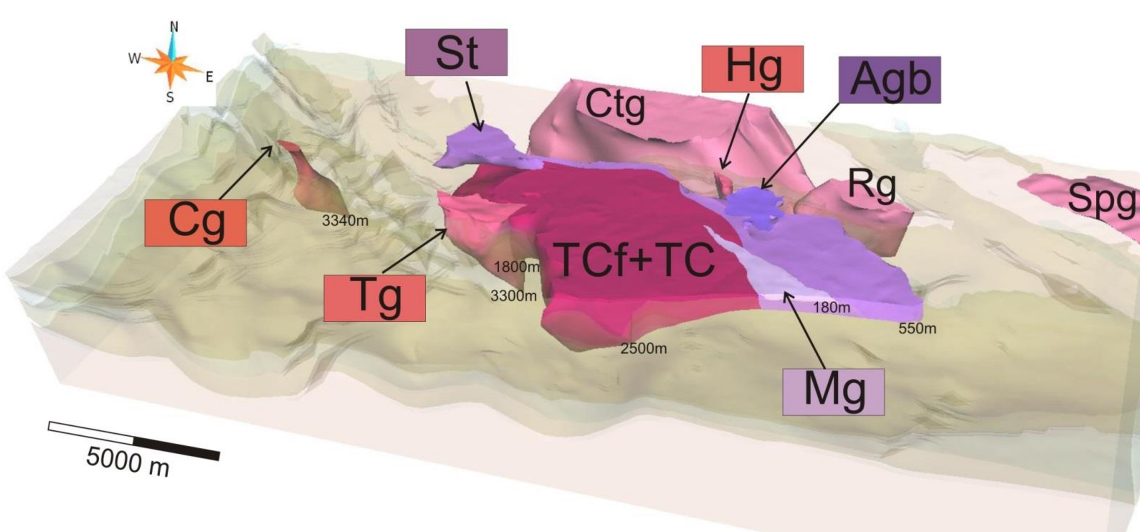
Lithology	Measured Density d (g/cm³) Range	Avg	Measured Susceptibility k (*10-6 ucgs) Range	Avg	Modelling PROFILE- F4 Density	Susceptibility
SNegra Fm (1)	2.27 - 2.88	2.61	2 - 3,017	124	2.62-2.64	0-2,000
LDF-Bodonal Fm (2)	2.18 - 2.74	2.56	1 - 5,734	784	2.56-2.60	0-3,000
CDF (4)	2.36 - 2.95	2.73	5 - 1,336	135	2,73	0
UDF (6)	2.81 - 2.25	2.58	1 - 13,697	1,289	2,58	0
MRV (7)	2.59 - 2.96	2.80	2 - 14,576	3,774	2,8	0
Barrancos Fm (BF, 9)	2.27 - 2.93	2.67	6 - 96	33	2.67-2.8	0
Terena Fm (TF, 12)	2.27 - 2.71	2.56	6 - 59	34	2.56	0
CASTILLO Pluton (CTg, 16)	2.54 - 2.74	2.60	13 - 58	39	2.54-2.58	0
TEULER pluton (Tg) (23)	2.59 - 2.68	2.63	7 - 2,053	766	2.68	2,000-3,000
SOM/CANTERAS (TC,18)+COMUN (TCF,19)	2.64 - 2.78	2.74	21 - 1,269	213	2.74	3,000-4,000
SOM/ SULTANA (St, 20)+DIORITOIDES (D, 21)	2.66 - 2.83	2.75	40 - 2,780	535	2.75	0
SOM/LEUCOGRANITES (Lg, 25)					2.6	1,000

The **initial geological model** (D in the above figure) is **fitted** with the **magnetic and gravimetric** data (A and B in the figure), rendering an improved model (cross-section C in the figure). For doing this, petrophysical properties has been used too (E in the figure).

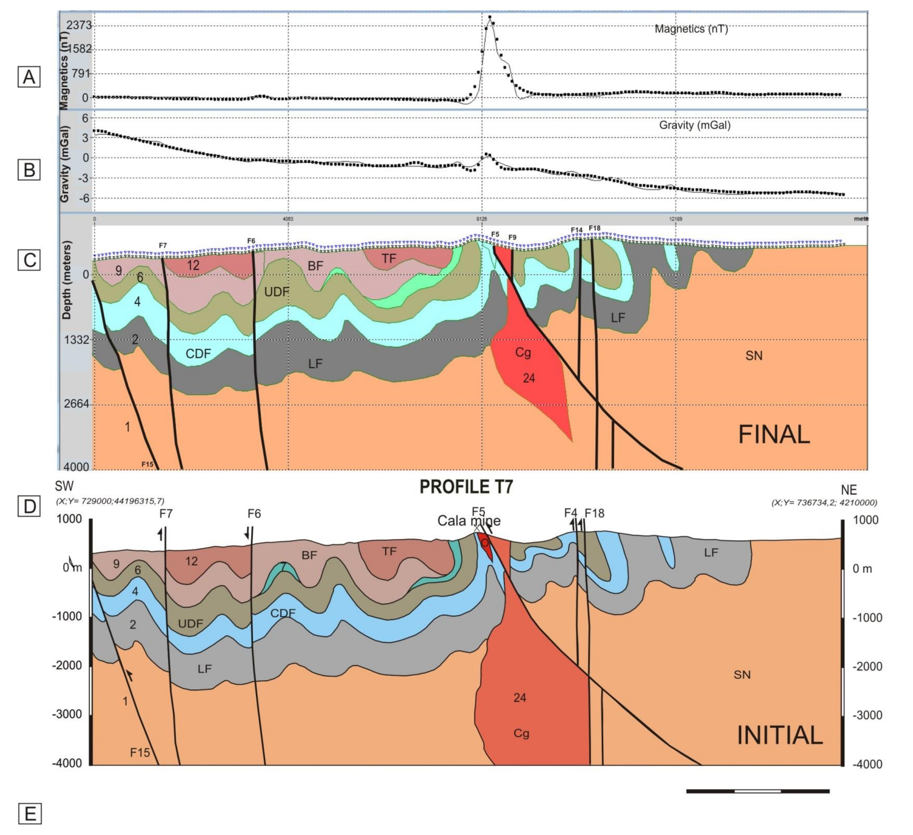
MODEL







PROCESSED DATA



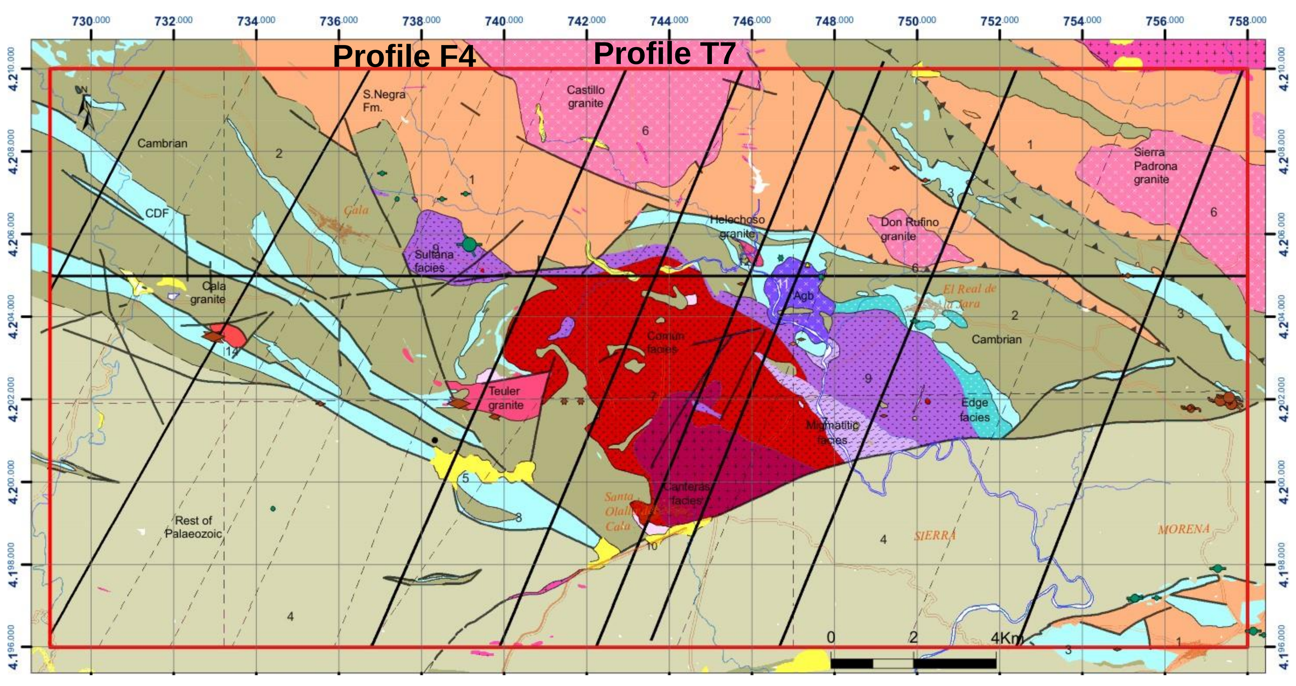
Lithology	Measured Density d (g/cm³) Range density	Avg. Density	Measured Susceptibility k (*10-6 ucgs) Range Sucept	Avg. susceptibility	Modelling PROFILE- T7 Density	Susceptibility
SNegra Fm (1)	2.27 - 2.88	2.61	2 - 3.017	124	2.61-2.67	0-1000
LDF-Bodonal Fm (2)	2.18 - 2.74	2.56	1 - 5.734	784	2,56	0-1000
CDF (4)	2.36 - 2.95	2.73	5 - 1,336	135	2,73	0-1000
CDF-Skarn (5)	2.58 - 3.51	3.06	22 - 3,853	780	2,9	25000
UDF (6)	2.81 - 2.25	2.58	1 - 13,697	1289	2,58	0
MRV (7)	2.59 - 2.96	2.80	2 - 14,576	3774	2,8	0
Barrancos Fm (BF) (9)	2.27 - 2.93	2.67	6 - 59	33	2.65-2.70	0
Terena Fm (TF) (12)	2.27 - 2.71	2.56	13 - 58	34	2,56	0
CALA pluton (Cg, 24)	2.65 - 2.67	2.66	8 - 555	127	2,66	10000

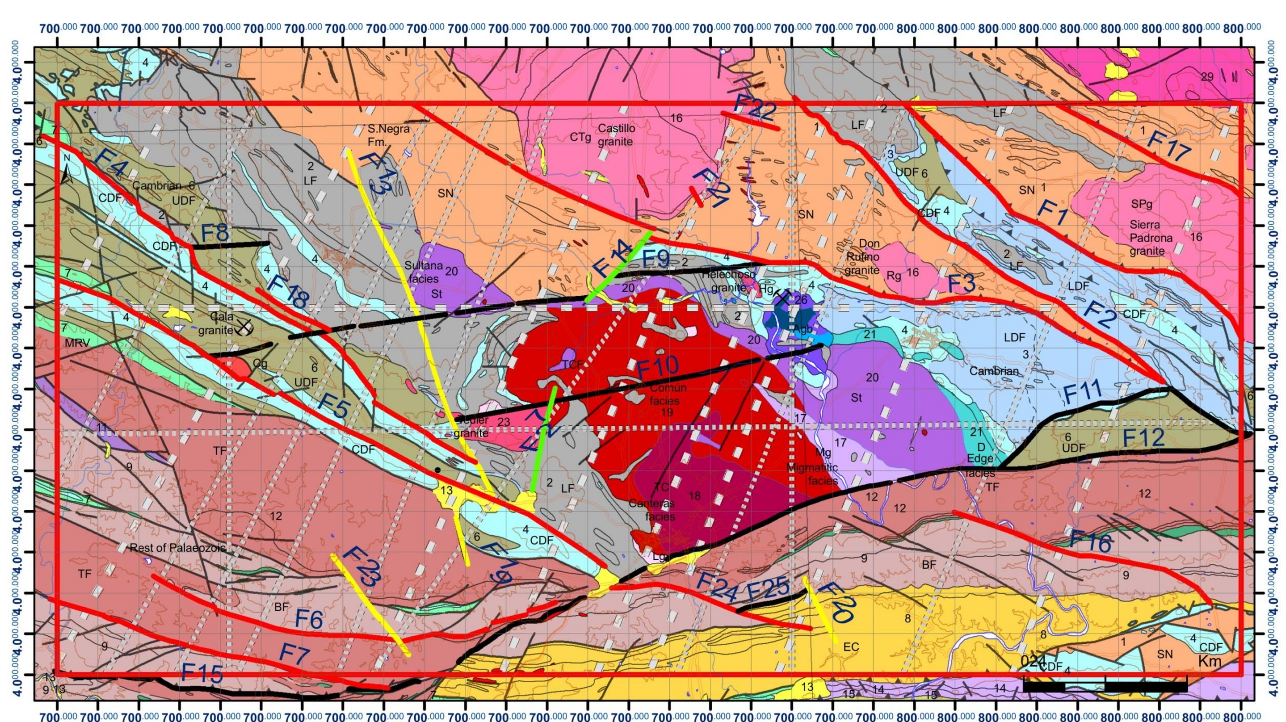
The main differences between initial (D) and final (C) model is the change in volume and shape of the plutons, revealing a **laccolithic appearance** with rooting zones, some of them related to faults. However, no significant changes in the metasedimentary units were observed .

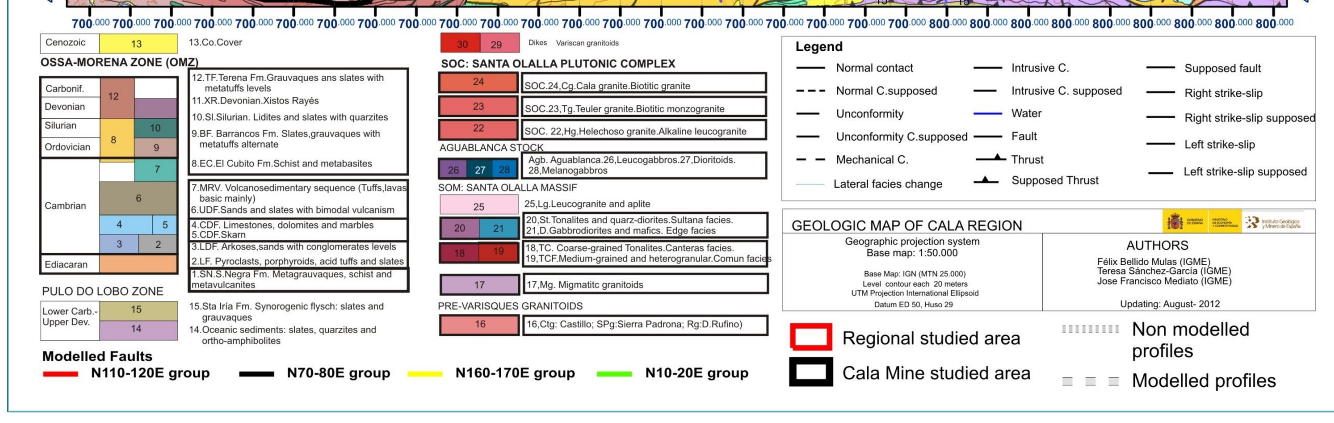
A set of **9 parallel geological cross-sections** across the relevant structures has been modelled (with the corresponding petrophysical properties) and fitted by **forward modelling**.

For this task we have used the latest GM-SYS software (by Geosoft).The observed anomalies were fit mainly by changes in the geometry of the different lithologies. In some cases, the changes were significant.

GEOLOGY







The previous geological map has been improved, and **30 units** have been distinguished: 15 metasedimentary and 15 plutonic. In the figure below the modelled faults for the 3D model can been seen.

20 cross-sections have been performed, crossing the main strucures and taking into account the surface geology and radiometric maps.

The units has been reduced and grouped into **8 plutonic**:

- Pre-Variscan granites
- SOM/Migmatitic
- SOM/Canteras & Común
- SOM/Sultana & Dioritoids)
- Aguablanca (Agb) stock
- Cala (Cg)
- Teuler (Tg)
- Helechoso (Hg)

and **4 metasedimentary**:

- the Serie Negra Formation
- the Cambrian metasediments and volcanics
- the Lower Cambrian Carbonate Detrital Group (DCG),separated because it is a good reference level in the area
- other Paleozoic metasediments

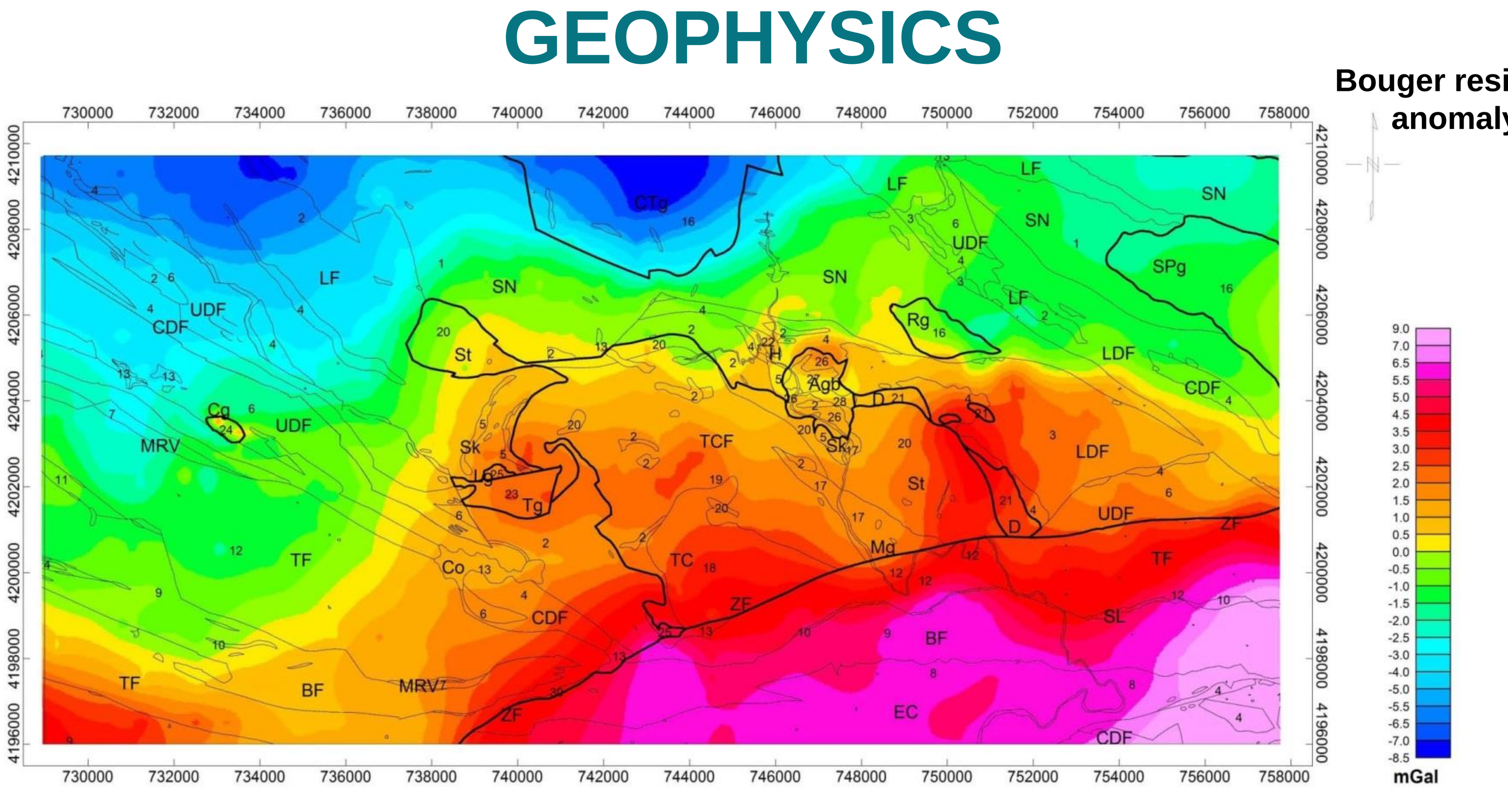
Several families of **faults** have been distinguished (in different colors on the geological map), **29** of which has been **modeled** .

ACKNOWLEDGEMENTS

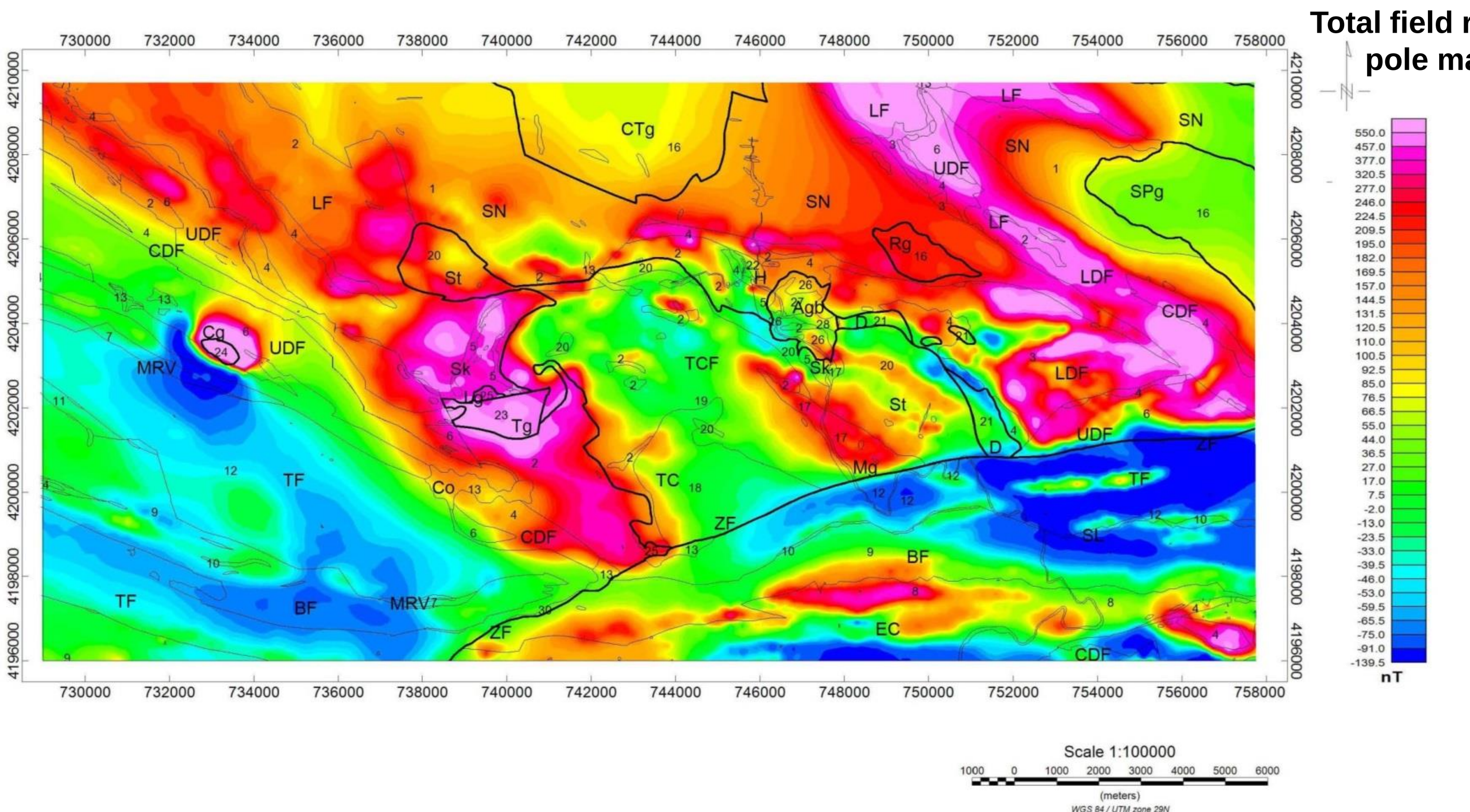
This research has been supported by the ProMine project "Nano-particle products from new mineral resources in Europe" within the VII Framework Programme for research (NMP-2008-4.0-5, contract 228559).

GEOPHYSICS

Bouger residual anomaly



Total field reduced to pole magnetic



In this work we have also realized a new gravimetric survey (2 points per km²) and petrophysical data, totalizing 490 gravity stations and 414 petrophysical samples.

The residual Bouguer anomaly map displays a broad and intense, several kilometres long, gravity gradient increasing from the northwest to the southeast.

Regarding discrete anomalies, total field reduced to the pole aeromagnetic map of above figure displays a great variety of long and short wavelength anomalies ranging between -139 and +550 nT. Positive anomalies can be seen, principally related to volcanic rocks. The main plutonic body (SOM) is delineated by low values of magnetic field (TCF, TC facies). Migmatitic facies (Mg) of the SOM show positive anomaly.