

Geophysical Approach of the Pb-Zn mineralization of the Verviers synclinorium (Belgium)



GeMMe

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Context

Complexity of the new ore deposits discoveries

- Lower grade
- Smaller size
- Higher depth
- Complex mineralogy

=> Need more adapted and improved geophysical prospecting methods

Belgian MVT deposits



Fig 1: location of Pb-Zn deposits in Belgium (Dejonghe et al., 1990b)

Extraction of Fe, Zn and Pb in more than 200 localities from historical time until the early 20th centuries

Three Pb-Zn districts in Belgium; the most prolific one is localized in the eastern part of Belgium in the Verviers synclinorium (Fig 1)

Belgian Pb-Zn deposits are formed in three steps:

1) Formation of dense brines from evaporated sea water during the Middle Devonian era. These dense brines have percolated until the Cambro-Silurian basement (Dewaele et al., 2004)

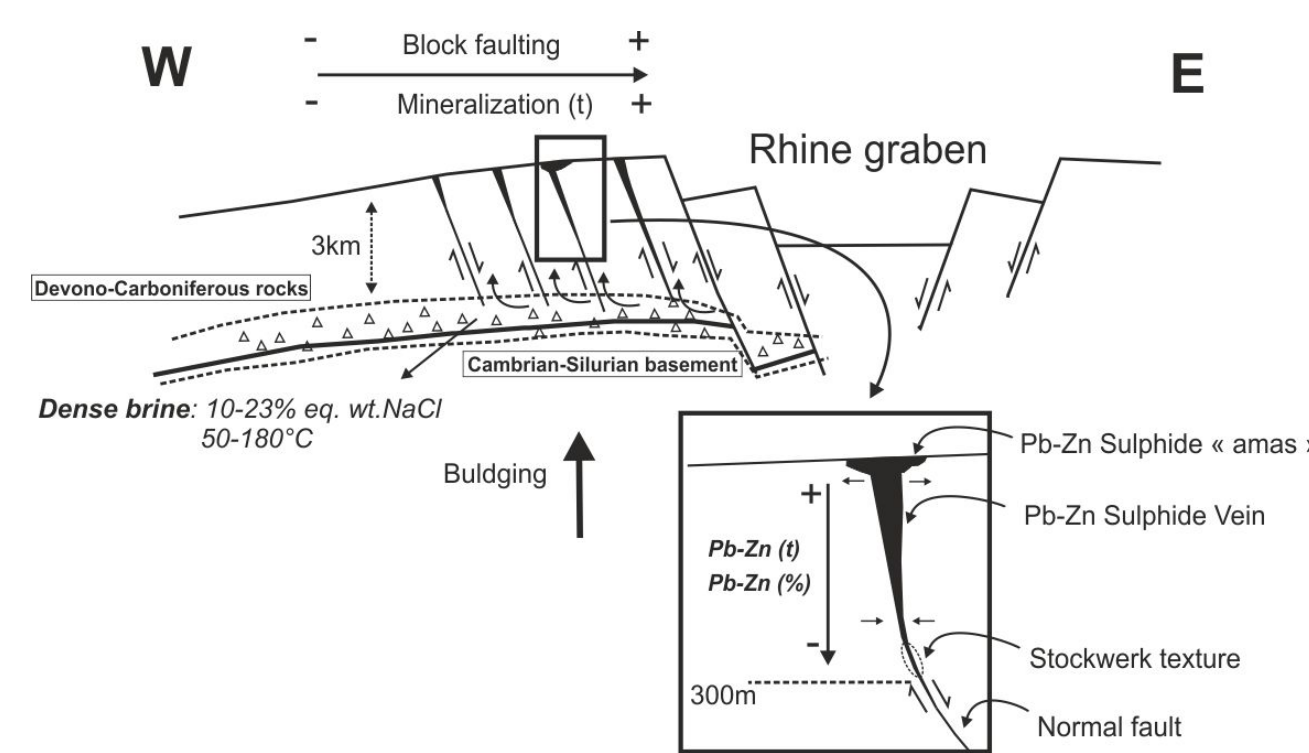


Fig 2: Genesis of the Belgian MVT deposits

2) Folding and faulting of the sedimentary rocks during the Hercynian orogeny (Late Carboniferous era)

3) From Permian to Tertiary periods, formation of transversal faults due to the extension of the Rhine graben. Mineralization of Pb-Zn-Fe sulphides during Jurassic era due to a suction pump mechanism (Fig2) (Mucchez et al., 2000)

○ Pb-Zn mineralization host in Carbonated (and siliclastic) rocks aged from Late Paleozoic (Fig 3)

○ Ore deposit controlled by lithological and structural settings

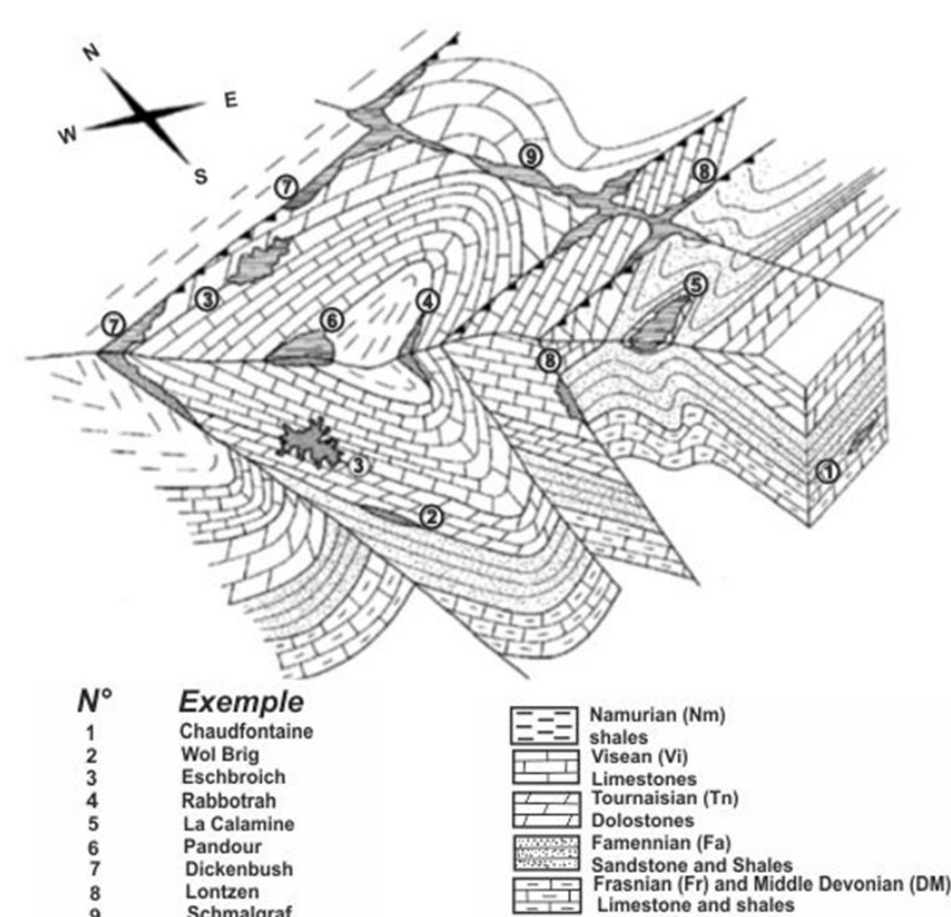


Fig 3: geological environment of the Pb-Zn mineralization

3D modelling

A drilling program has been achieved in the 90's in the Plombières region and have crosscut Pb-Zn mineralization under old mining works at depth between 90 and 220m.

The Pb-Zn mineralization has been modelled with Micromine in order to better target it with geophysical methods. This modelling give information about size, length, width, depth and texture of the Pb-Zn mineralization (Fig 4).

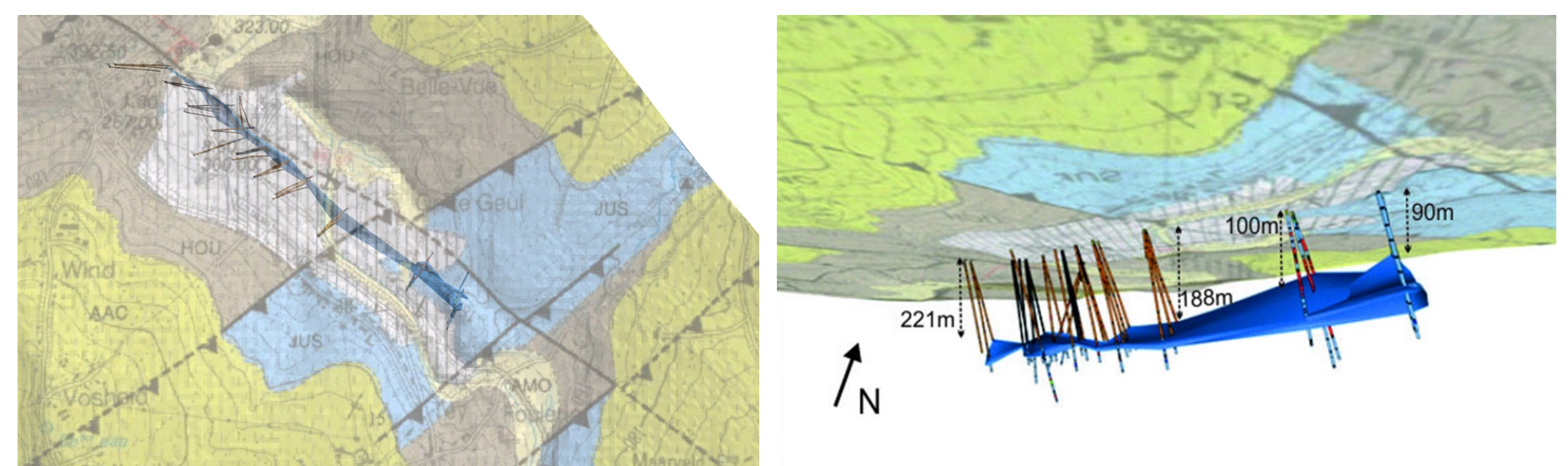


Fig 4: 3D modelling of the Pb-Zn mineralization of Plombières

The Pb, Zn and Ag grades have been extrapolated using SGEMS software (Fig 5)

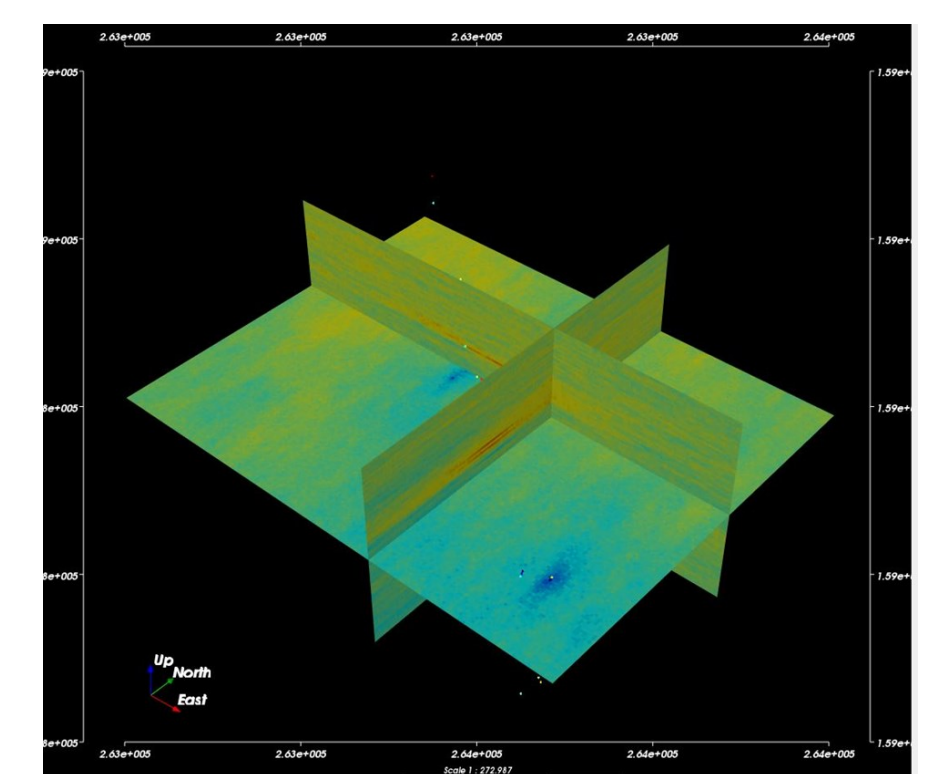


Fig 5: SGEMS modelling

-> Modelling information are important to better understand the genesis and the emplacement of the deposit and to constrain the geophysical inversion.

Geophysics

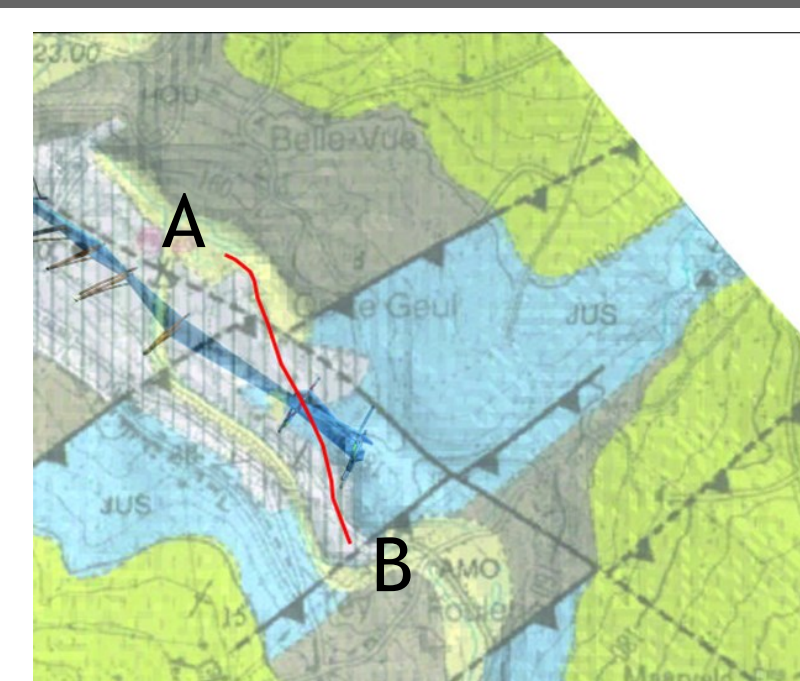


Fig 6: location map

Three geophysical methods are used to target the Pb-Zn mineralization of Plombières (Fig 6)

-Magnetometric method to detect the faults which are linked with mineralization events (coming work)

-Electrical methods: resistivity and induced polarization methods (Fig 7)

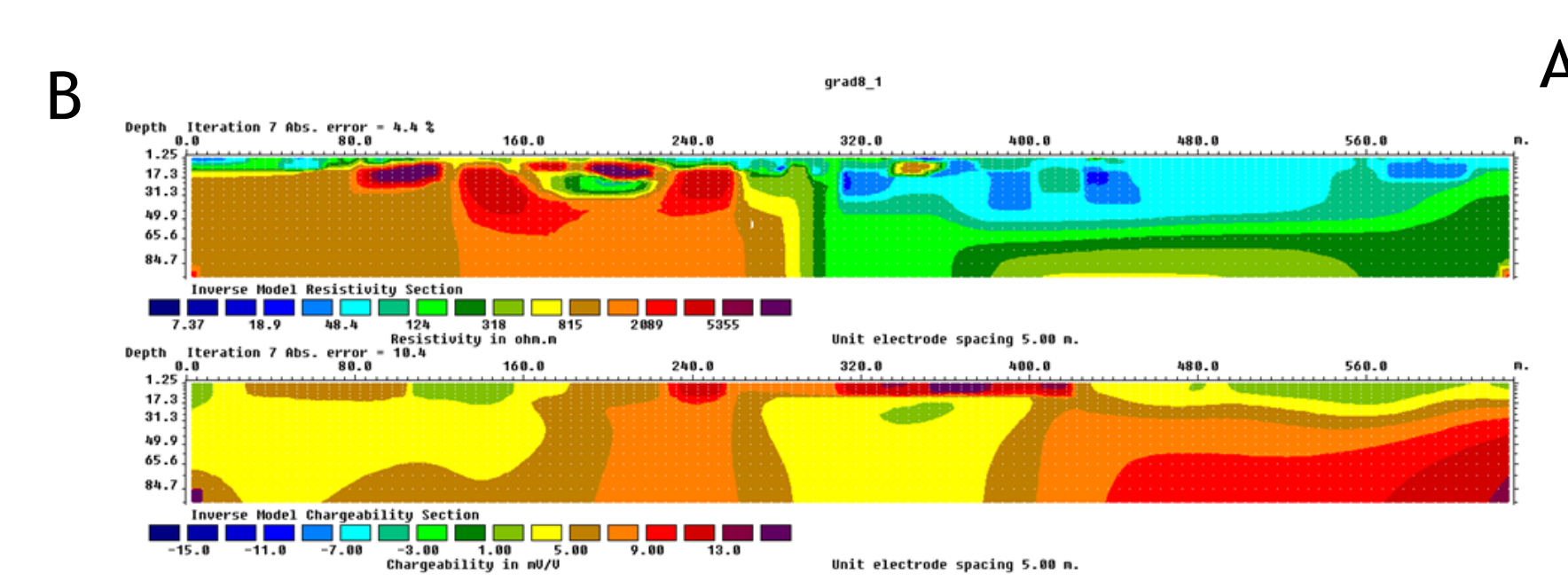


Fig 7: resistivity and chargeability profile

- Gravity method: detect the contrast of density between the mineralization and the host-rocks (Fig 8)

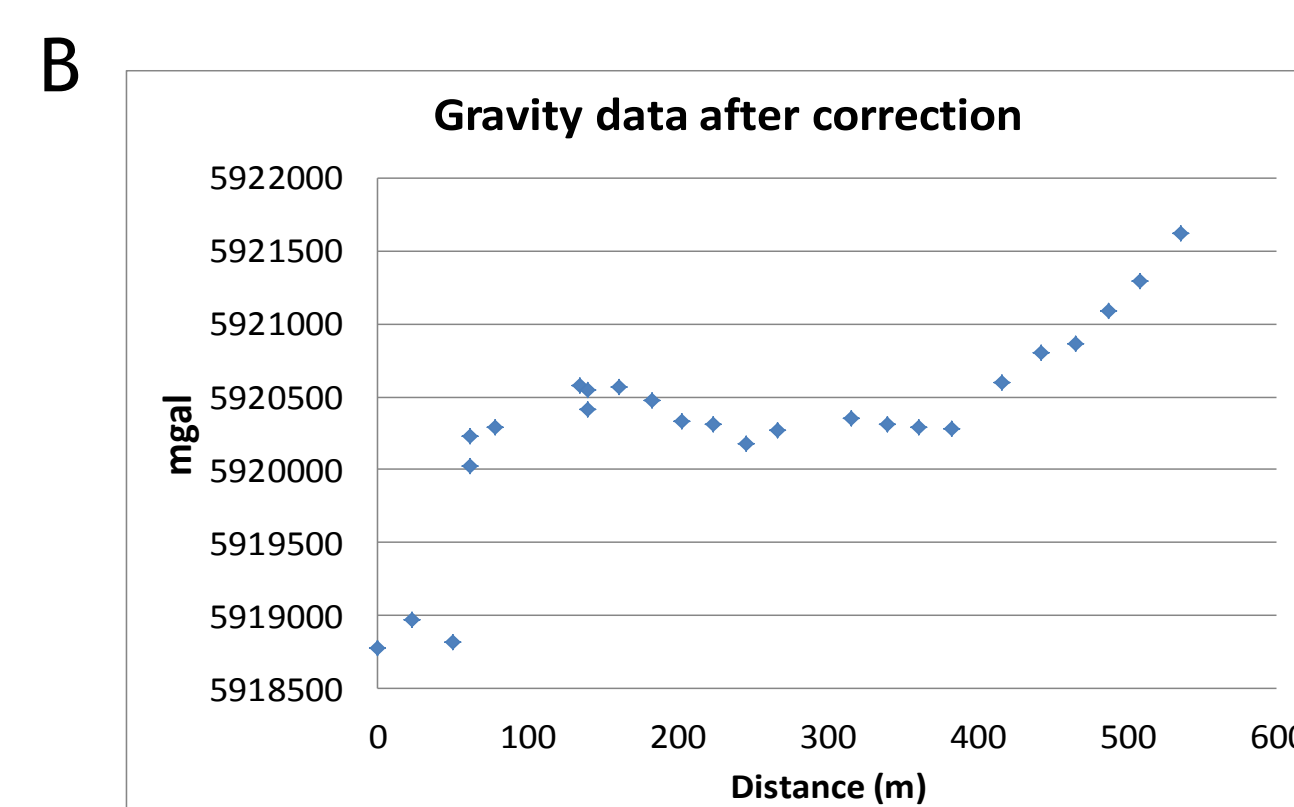


Fig 8: gravity data



Geophysical inversion

Innovative inversion techniques:

-cooperative inversion: taking the best of the 3 geophysical methods (coming work)

- Inversion of the unique geological model: the 3 geophysical methods are inverted together (coming work)

...coupled and constrained with geostatistics and log data from modelling



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