Geophysical investigation of the Lontzen Pb-Zn ore deposits

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Location

Pb-Zn districts of Belgium

(Dejonghe 1985a;b, 1990b, modified)
Liège and the Zinc

Liège: First industrial production of zinc metal (1809)
27% of the European zinc production (1854)
17 000t/year

J-J Dony

La Calamine zinc deposit

Liège smelter
Goal of the project

- Target the Belgian Pb-Zn ore deposits using geophysics

- Better understand the geology and the genesis of these deposits

- Improve imaging using joint or cooperative inversion

- Better detection, targetting and estimation of the grades/tonnage
Pb-Zn districts of Belgium

(Dejonghe 1985a;b, 1990b, modified)
MVT deposit of Belgium

Deposit of Dickenbusch (Dejonghe et al., 1993)
Mississippi Valley Type

N° | Exemple
---|----------
1  | Chaudfontaine
2  | Wol Brig
3  | Eschbroich
4  | Rabbotrah
5  | La Calamine
6  | Pandour
7  | Dickenbush
8  | Lontzen
9  | Schmalgraf

- Namurian (Nm)
- shales
- Visean (V)
- Limestones
- Tournaisian (Tn)
- Dolostones
- Famennian (Fa)
- Sandstone and Shales
- Frasnian (Fr) and Middle Devonian (DM)
- Limestone and shales

Dejonghe and Jans 1983
Geological context
Verviers synclinorium
Old mining work in the Verviers synclinorium

Dejonghe 1998
Lontzen deposit

Dejonghe 1998
Study area

- N Namurian
- V Visean
- T Tournaissian
- F Famenian

750m
Lontzen/Poppelsberg mineralogy

- Massive sulphides (95%)
  - Sphalerite, galena, pyrite/marcasite, chalcopyrite...

- Massive oxides (5%)
  - Smithsonite, limonite, cerusite...
Hole-drilling program

55 hole drill

750m
3D modeling
3D modeling
Geophysics survey on the field

- **Electrical survey**: Electrical Resistivity Tomography and Induced Polarisation
- Gravity survey
- Electromagnetic survey
- Magnetometry
1. Electrical survey on the field
Electrical survey on the field

Correction

-DOI

-%Var

Resistivity in ohm.m
ERT survey
Electrical survey on the field

IP results

Chargeability mV/V

50%

47%

52%

45%

42%

30%

33%

Poppelsberg East

Poppelsberg West

300m

Hole-drill
IP results
2. Gravity survey on the field

Scintrex CG5
Expected results
Gravity survey on the field

Profiles:
1. Profile 1
2. Profile 2
3. Profile 3
4. Profile 4
5. Profile 5
6. Profile 6
7. Profile 7
8. Profile 8

Delta values in μgal vs. Distance (m)
Gravity survey on the field

Gravity profiles in Lontzen area

Legend

981.773968

- 68.962804 - 65.171140
- 65.171141 - 167.205084
- 167.205085 - 296.920170
- 296.920171 - 479.235354
- 479.235355 - 677.271022
- 677.271023 - 964.828912
- 964.828913 - 1290.448868

Lontzen
Gravity data

Resistivity profiles investigation in Poppelsberg
3. Electromagnetic survey

EM-34 profiles in Lontzen area

Legend

40m_vert
Std deviation
- < -2.5 Std. Dev.
- -2.5 - -1.5 Std. Dev.
- -1.5 - -0.50 Std. Dev.
- -0.50 - 0.50 Std. Dev.
- 0.50 - 1.5 Std. Dev.
- 1.5 - 2.5 Std. Dev.
- > 2.5 Std. Dev.

Pb-Zn vein

<table>
<thead>
<tr>
<th>Spacing</th>
<th>Configuration</th>
<th>Depth of investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>20m</td>
<td>Horizontal</td>
<td>15m</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>30m</td>
</tr>
<tr>
<td>40m</td>
<td>Horizontal</td>
<td>30m</td>
</tr>
<tr>
<td></td>
<td>Vertical</td>
<td>60m</td>
</tr>
</tbody>
</table>
20m_spacing (70’) coaxial
(1,6kHz => 15m (50’))
EM 34-3 survey

40m coaxial
(0.4kHz => 30m)
EM 34-3 survey

20m coplannar (1,6kHz => 30m)
EM 34-3 survey

40m coplannar (0,4kHz =>60m)

EM-34 profiles in Lontzen area

Legend
40m_hor
Std deviation
-2.5 - 1.5 Std. Dev.
-1.5 - 0.5 Std. Dev.
-0.5 - 0.5 Std. Dev.
0.5 - 1.5 Std. Dev.
1.5 - 2.5 Std. Dev.
> 2.5 Std. Dev.
Pb-Zn vein
Electromagnetic anomalies

Big anomalies on the Northern part of Poppelsberg East vein
Discussion (ERT/EM)
4. Magnetometry survey

Magnetic map of the Pb-Zn deposit of Poppelsberg

GSM-19 v7.0
GEM system
Conclusion

• 3D modeling of the Pb-Zn deposit of Lontzen allowed to
  • Better understand the geology and the genesis of the deposit
  • Target the deposit to explore it using geophysics

• Geophysics on the field:
  • Electrical survey: The best technique in our case study
  • Gravity survey: mixed result
  • EM survey: good results on a part of the vein
  • Magnetometry: no para or ferro magnetic mineral
  • ...
Further works

2D/3D (?) Inversion of the data
- Constrain the inversion with drill hole information
- Cooperative/joint inversion
- Inversion of the unique geological model in minimizing a objective common function

Geophysical campaign
- 600m ERT/IP profiles to target the Pb-Zn mineralization at higher depth
- IP using MPT-DAS at different frequencies
- Exploration in brownfields
Further work
Thank you for your attention