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Evaluation of SP Anomalies in Mine Field

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SUMMARY

In this study, an example is given about the approach to SP maps prepared in sulfurous mining areas. For this purpose, a way was determined about how to arrive a real earth model examining through the results of different SP models. The solutions indicated that the examination of 2D SP map obtained in the mining area do not reflect the real earth model all the time. A prediction related to sulfurous metallic mining area was done. At first, although four sources had been thought to produce SP anomalies, later it was understood that seven sources produced SP anomalies in the map.
EVALUATION OF SP ANOMALIES in MINE FIELD

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ABSTRACT
In this study, an example is given about the approach to SP maps prepared in sulfurous mining areas. For this purpose, a way was determined about how to arrive a real earth model examining through the results of different SP models. The solutions indicated that the examination of 2D SP map obtained in the mining area do not reflect the real earth model all the time. A prediction related to sulfurous metallic mining area was done. At first, although four sources had been thought to produce SP anomalies, later it was understood that seven sources produced SP anomalies in the map.

KEY WORDS
Spontaneous potential, Inversion, Marquardt, Giresun, Copper

INTRODUCTION
Sulfurous minerals, constituting source of SP and IP methods, are generally complex cases in subsurface. SP effects are linear spread potential. Thus, it cannot be understood whether the potential effects are caused by total mass of a sulfurous ore or a potential of ore zone or a potential of alteration zone. The rock voids where ore is formed can be reviewed into two main groups. The first one is that the ores forming in pylon type of voids. Ores forming in fault zones are shaped between the anticlinal and the synclinal bends. The second one is that the ores forming in the porous rocks are shaped in the layers of sedimentary rocks and in the gas voids of volcanic rocks. While mathematical approaches that are used for interpretation of the field data can be successful in some methods such as gravity-magnetic with potential source, but it is difficult to use those methods for the SP method (Çağlar 1991). In this study, an approach tried to be done in order to find out how a mine field, in which geological conditions are unknown, should be evaluated. After examining the solutions of different types of SP models, the solutions obtained are discussed. The method of non-linear least squares, Marquardt (1963) is used.

THEORY
In the modeling stage, instead of adjusting the data (smoothing, filtering), the approaches and the evaluation of results with the use of various models including point load (Banerjee, 1970), two load (Banerjee, 1970), inclined sheet (Roy ve Chowdhury, 1959), vertical sheet (Atchuta Rao ve Ram Babu, 1983), sphere, and cylinder (Bhattacharya ve Roy, 1981) models would provide more realistic solutions.

APPLICATION
The study field is the Boztekke copper mine, which is around Giresun, Akköy (Figure1)
The Figure 1 shows that Giresun where upper-Cretaceous volcanic facies fields occupy a large terrain in especially its northern parts, and the core of the mountains, which is made of granadiorit, was resulted by Alp orogeny's folded mountain (Boztuğ ve diğ. 2004). During the Mesozoic and the Cenozoic periods contortions, refraction and subductions had been occurred. Geology of Giresun and its environment are given in the Figure 2.

Figure 2. Ore (Cu, Pb, Zn) deposits in Giresun City and its vicinity (Acar, 1973)

SP contour map of Giresun-Boztekke copper field and the profiles are shown in Figure 3. Examining these fields give an SP anomaly, It is thought that they took shape in a fault zone. At first sight, it is thought that they took shape in the direction of fault slope or vertical position since they took shape in the fault zone. Conversely, having examined all of those anomalies, A-A', B-B' C-C' and D-D' anomalies were observed as making angles with the horizontal axis having tail anomalies. SP anomalies of the A-A' profile is shown in Figure 4.

Figure 3. SP contour map of Giresun-Boztekke copper field and profiles (MTA).

Interpretation for Profile A-A'

Figure 4. SP anomalies over A-A' profile, Figure 5. Model solution applied in A-A' profile.
As seen from the Figure 3, a closure is observed as a right-sided in the figure in the A-A’ profile. An inline dike model was used (Roy ve Chowdhury, 1959) in the interpretation. The results are shown in Table 1.

Table 1. Model results of A-A’ profile

<table>
<thead>
<tr>
<th>Parameters</th>
<th>M</th>
<th>h</th>
<th>H</th>
<th>D</th>
<th>Q</th>
<th>T</th>
<th>C</th>
<th>RMS</th>
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<tbody>
<tr>
<td>Initial data</td>
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<td>4</td>
<td>18</td>
<td>30</td>
<td>90</td>
<td>0</td>
<td>0</td>
<td>84.84</td>
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<td>Calculated data</td>
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<td>25.79</td>
<td>145.51</td>
<td>0.934</td>
<td>-110.06</td>
<td>14.98</td>
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If model solution given in Figure 5 is subtracted from cross-section A-A’ given in Figure 4, the rest represents the mass which produces SP anomalies (Figure 6).

Figure 6. SP anomaly derived from solution of inclined sheet and Two SP anomalies btained removing the biggest amplitude from A-A’ profile. Left box indicates A1 while right A2.

The solutions of anomalies given in (A1) and (A2) are shown in Table 2.

Table 2. Horizontal cylinder solutions of A1 and A2 SP anomalies.

<table>
<thead>
<tr>
<th>Parameters (Sphere model) A2</th>
<th>M</th>
<th>H</th>
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<th>D</th>
<th>T</th>
<th>C</th>
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<td>95</td>
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<table>
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<th>D</th>
<th>T</th>
<th>C</th>
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<tbody>
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<td>50</td>
<td>0</td>
<td>0</td>
<td>9.7</td>
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<td>14.61</td>
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<td>5.82</td>
<td>-304.01</td>
<td>0.1</td>
</tr>
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</table>

A joined model which has been produced by summation of the theoretical dike model (Table 1) and theoretical sphere models (A1 and A2) (Table 2) are given in Figure 7.

Figure 7. Joined model solutions applied in A-A’ profile. Red: Joined solution, Blue: Field data.
CONCLUSIONS

In SP studies, which are done for exploration of the sulphide minerals, the location of the ore bodies were being determined by examining the maps. On the other hand, the formation of mineral deposits may cause an erroneous evaluation. In this study, there is generally a contradiction between anticipated ore positions and determined ore positions, when the SP closure is examined in the study field. This result could be caused by the form of mineral deposits, the faulting, and the flexions, produced by the tectonism. It should not be overlooked that the SP may be caused by any other reasons except for the ore. If any unusual situation is observed in the map, another acceptable method should be applied for examination of the map.

Acknowledgement
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REFERENCES


