INTRODUCTION

Located in the Portuguese sector of the Iberian Pyrites Belt, the São Domingos Mine was exploited in the roman period, and between 1857 and 1986 by the Mazar & Barry Company. The mining activity produced an amount of 25 Mt of mining residues (Alvarez-Valejo et al., 2007), all of them with high metal contents (Matos et al., 2011).

This work aims at evaluation of some of these wastes, namely those located in the mine northern sector (Fig. 1), considered as high economic potential, due to the high Au and Ag contents. These materials are characterized by gossan, volcanic and sedimentary ore host rocks, and were mapped in detail by Matos (2004) and evaluated by the spanish mining company Compañía Nacional de Piritas, S.A.(CONASA), between 1990 and 1991. The residuals are heaped in wastepiles (Figs. 1 and 2) and as landfill, as part of the mining residues used for the construction of the Mine de São Domingos village and industrial areas earthworks (Fig. 1).

Tridimensional individual volumes were modeled for the sampled wastepiles, aswell for the sampled landfill areas, and Au and Ag resources were estimated in each model.

GEOCHEMICAL DATA

The waste modelling and resource estimates were based on a data set from LNEG archives (Portuguese Geological Survey), comprised by historical drilling and sampling campaign by CONASA (Matos and Mora, 1991), detailed mine waste mapping (Matos, 2004), and a digital elevation model of the area (Quental et al., 2002).

The CONASA sampling was carried out in four different waste classes: gossan (W1), felsic volcanics (W2), shales (W3) and in some landfill areas (W4) (Fig. 2), by means of reverse circulation drilling (RC) for sampling, and pitting for size fraction sampling and precise waste thickness measurements. The dataset contains 160 boreholes (total of 1,884 m) and 162 pits (total of 1,307 m), totaling 1148 samples assayed for Au and Ag.

The individual pit samples were sorted into 4 size fractions of >40 mm, 40-9 mm, 9-5 mm and <5 mm, and assayed for Au and Ag. Size fraction analysis revealed that an overall increase in Au correlates with an average grade above 0.5 g/t. There seems to be no apparent correlation between Au grades and size fraction, being the average grades of size fractions very proximate.

MINE WASTE VOLUME MODELLING

The waste volume modelling was performed by defining a group of boundaries for each waste pile: the present terrain surface (upper boundary), the original terrain surface, before the waste heaping (lower boundary), and a polygon representing the extent of the piles lateral wastepile boundary (Fig. 3).

The upper boundary was extracted from a digital elevation model (DEM). The lower boundary was interpolated with a spline function in a GIS environment (ArcMap) from the coordinate points of the base of the piles (true waste thickness) and the boreholes. Due to the large extent of the lower surface boundary and the small survey dataset, the quality of the model was assessed by modelling its drainage network, and comparing it with the one mapped in a 19th century (Ribeiro, 1857), prior to waste dumping.

Tridimensional individual volumes were modeled for the sampled wastepiles, aswell for the sampled landfill areas, and Au and Ag resources were estimated in each model.

For all modelled are very low, averaging between 0.19 to 0.21 g/t Au and 2.70 to 2.83 g/t Ag. Three of the eight piles composed of felsic volcanics and shales (class W2) were also excluded, with average grades ranging from 0.08 to 0.49 g/t Au and 0.60 to 5.76 g/t Ag. Only one model of the gossan wastes class (W1) was excluded, averaging 0.43 g/t Au and 5.08 g/t Ag. None of the landfill models (class W4) were excluded.

CONCLUSIONS

The results revealed an inferred mineral resource of 2.38 Mt in the non-conditioned volumes of the high grade waste piles and landfill models (Au >0.5 g/t), with an average grade of 0.77 g/t Au and 8.26 g/t Ag, totalling a metal content of 59,489 oz t gold and 633,488 oz t silver. If the considered part of the volumes were to be considered, the mineral resource increases to 2.94 Mt with an average grade of 0.77 g/t Au and 8.27 g/t Ag, corresponding to 72,871 oz t Au and 781,531 oz t Ag. If all the 17 waste piles and 6 landfill volumes modelled in this investigation were to be considered, i.e., including both high and low grade models, and the portions with probable conditioned exploitation (defined and protected areas), the mineral resource could be increased to 4.0 Mt with an average grade of 0.64 g/t Au and 7.30 g/t Ag, corresponding to a metal content of 82,878 oz t gold and 957,753 oz t silver.

In possible future mine extractive projects, a further detailed knowledge is needed, complementary to the existing data. The characterization of the fine vertical zonation of the mining waste will be essential to define high grade levels within the wastes. In future land use plans of the São Domingos mining area, the balance between economic mine profit and negative impacts of the waste exploitation must be done, and a re-mining phase must be properly planned considering the mine rehabilitation plan and current heritage promotion projects. In this balance, is essential to improve the knowledge related to the existing geological resources. The present evaluation work is a contribution to the understanding of the São Domingos mining potential.

REFERENCES

Alvares-Valejo, A., M.A. Marques, J.M., Lopes, L., Matos, J.X., Martins, R., 2011. Tridimensional individual volumes were modeled for the sampled wastepiles, aswell for the sampled landfill areas, and Au and Ag resources were estimated in each model.

Table 1 - Resource estimates in the non-conditioned volumes of the wastepile and landfill models with an average Au grade above 0.5 g/t.

<table>
<thead>
<tr>
<th>Waste class</th>
<th>W1</th>
<th>W2</th>
<th>W4</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity (t)</td>
<td>613,208</td>
<td>667,150</td>
<td>1,105,121</td>
<td>2,385,479</td>
</tr>
<tr>
<td>Grade (g/t)</td>
<td>1.07</td>
<td>0.71</td>
<td>0.65</td>
<td>0.77</td>
</tr>
<tr>
<td>Contained metal (oz t)</td>
<td>21,145</td>
<td>15,266</td>
<td>23,078</td>
<td>59,489</td>
</tr>
<tr>
<td>Au</td>
<td>197,443</td>
<td>184,581</td>
<td>251,464</td>
<td>633,488</td>
</tr>
<tr>
<td>Ag</td>
<td>891,433</td>
<td>752,541</td>
<td>1,051,464</td>
<td>2,695,438</td>
</tr>
<tr>
<td>Total metal</td>
<td>1,193,262</td>
<td>1,037,162</td>
<td>1,699,784</td>
<td>3,930,208</td>
</tr>
</tbody>
</table>

These criteria excluded all the wastepiles of the shales class (W3), in which the average Au and Ag grades for all modelled were very low, averaging between 0.19 to 0.21 g/t Au and 2.70 to 2.83 g/t Ag. Three of the eight piles composed of felsic volcanics and shales (class W2) were also excluded, with average grades ranging from 0.08 to 0.49 g/t Au and 0.60 to 5.76 g/t Ag. Only one model of the gossan wastes class (W1) was excluded, averaging 0.43 g/t Au and 5.08 g/t Ag. None of the landfill models (class W4) were excluded.