

Mineralogy and magnetic parameters of burning coal waste pile materials: A preliminary insight

J. RIBEIRO¹, H. SANT'OVAIA¹, C. GOMES²,
H. CORRÊA-RIBEIRO¹, Z. LI³, C. WARD³ AND D. FLORES¹

¹Centro Geologia UP, DGAOT, FCUP, R. Campo Alegre,
4169-007 Porto, Portugal (joanaribeiro@fc.up.pt)

²CGUC, DCT, Universidade Coimbra, Portugal

³School of Biological, Earth and Environmental Sciences.
University of New South Wales, Sydney, Australia

This work describes the changes in mineralogy and magnetic parameters of the waste pile materials from burning and unburned zones in the S. Pedro da Cova, Midões and Lomba areas of the Douro Coalfield, Portugal. X-ray diffraction analysis has provided information about the mineral phases and the reactions that occurred during the combustion process, and hence been used to identify the temperatures reached. The unburned coal waste materials contain quartz, illite, mica (mainly muscovite) and in many cases pyrophyllite. Some of the burnt coal waste samples have similar mineralogy to the unburned materials, but some contain mullite and cristobalite, suggesting that higher temperatures were involved in the combustion process. Low-field magnetic susceptibility (χ) and isothermal remanent magnetization (IRM) determinations were used to indicate the source of the magnetic mineralogy and the waste material contamination in burning parts of the S. Pedro da Cova and Lomba piles. In S. Pedro da Cova, the two highest values of χ (1217.60 and $556.22 \times 10^{-8} \text{ m}^3/\text{kg}$) were found in zones where the temperature was higher than 200°C , and in Lomba the two highest values (705.84 and $211.67 \times 10^{-8} \text{ m}^3/\text{kg}$) were found where the temperature was higher than 70°C . These temperatures were measured with a digital infrared thermometer when the samples were collected. In unburned zones χ ranges from 13.58 to $16.62 \times 10^{-8} \text{ m}^3/\text{kg}$. The IRM values of the S. Pedro da Cova samples show that remanence saturation was achieved at a magnetic field lower than 300 mT , suggesting the presence of a low-coercivity structure, magnetite-like phase. However, in the samples from Lomba, the imparted field was insufficient to achieve remanence saturation, probably because 'hard magnetic structures' are also present. The 'Index of Geo-accumulation' at S. Pedro da Cova and Lomba shows that the samples represent a strong to very strong contamination. Here the highest χ occurs where the combustion temperature was also very high, suggesting that the burning process was the main cause of the magnetic enhancement.

New $^{40}\text{Ar}/^{39}\text{Ar}$ and geochemical constraints on São Jorge Island, Azores

L.P. RIBEIRO^{1*}, A. CALVERT², Z. FRANÇA,
B.³ RODRIGUES⁴ AND M.P. ABREU¹

¹EMEPC, Lisbon, Portugal (luisapr@emepc-portugal.org)

²U.S. Geological Survey, Menlo Park

³Azores University, Portugal

⁴Aveiro University, Portugal

Twelve new $^{40}\text{Ar}/^{39}\text{Ar}$ ages, major and trace element geochemical data from several lava sequences at São Jorge Island, Azores, are presented. These data improve the temporal constraints on the volcanic and geochemical evolution of the island. Overall, in the Azores context, São Jorge was constructed by fault-controlled fissural volcanism, dominated by 150°N and the 120°N regional fault systems.

The stratigraphic and geomorphologic division of São Jorge into three main volcanic complexes (Topo, Rosais and Manadas [1, 2]), is congruent with most of the new and previous [3] geochronological data, however some adjustments are required. The new $^{40}\text{Ar}/^{39}\text{Ar}$ ages of 1310 and 1284 ka on São João lava sequence, the early sub-aerial volcanic phase, are within the time interval presented by [3]. When compared with the rest of the island, São João is a time-isolated volcanic event presenting high growth rates, a system of dikes trending 150°N , a geochemical signature distinct from the other complexes and lavas with a singular lithological composition [4], thus it should be considered as a separated volcanic unit from Topo.

A second volcanic phase, building up Topo Complex, started at least at 757 ka lasting at least until 543 ka ago, despite some scarce late eruptions. Topo presents a strong alkaline affinity with a predominant basaltic composition. This stage is followed by the onset of the Rosais alkaline complex forming the western side of São Jorge at least until 117 ka ago. Rosais presents relative enrichment in K_2O and P_2O_5 , and shows evidences for coeval volcanism across the complex as verified by the lava sequences at Fajã do Ouvidor, starting at 368 ka [3] and at João Dias, estimated to have started at 360 ka and continued after 215 ka ago. The early Manadas eruptions are not constrained by this study, but volcanism is concentrated on the center of the island and remains active until present day with two sub-aerial historical eruptions, 1580 and 1808 A.D. The new data shows that these alkaline lavas have a tendency to be sub-saturated.

[1] Forjaz & Fernandes (1975) *Portuguese Geological Services*; [2] Madeira, (1998) *PhD Thesis* [3] Hildenbrand *et al.*, (2008) *EPSL* [4] Ribeiro *et al.*, (2007) *Geoph. Res. Abst.*