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MONITORING GEOSITES: A GEOCONSERVATION TOOL AT AZORES GEOPARK

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The Azores archipelago is located in the North Atlantic and is composed by nine islands and some islets. This archipelago, and the surrounding seafloor, has a remarkable geological heritage of international scientific relevance, which constitutes the basis for the establishment of a geopark that is under evaluation by the European Geoparks Network (EGN). Its integration in the EGN is expected for September 2012 (Lima *et al.*, 2010a).

Lima *et al.* (2010b) have identified 121 geosites in the 9 islands and surrounding seafloor, most of them with international and national relevance. Based on this inventory and on the major goals of a geopark, 57 geosites were selected to be managed by the Azores Geopark.

In order to assure that geosites are well preserved considering its present use, a monitoring work was foreseen as a possible tool to geoconservation of these sites. This monitoring strategy intends to identify the factors affecting the geosite's values and to quantify the eventual decrease of relevance that geosites has been experiencing throughout time

As a first step on this geoconservation general strategy, during the last year a monitoring work has been under development in the geosite "Ponta da Ferraria e Pico das Camarinhas" (São Miguel island), given its importance for the Azores Geopark and its relatively ability for the strategy implementation. In what concerns the scientific value, this geosite occupies the 14th position among all the Azores geosites and the 3rd in S. Miguel Island (Nunes *et al.*, 2011). Ponta da Ferraria is a lava delta formed by the basaltic lava flows emitted from Pico das Camarinhas scoria cone, 840 ± 60 years ago (Nunes & Lima, 2009; Moore, 1991). Among the many geological features of the geosite, the littoral cone (or pseudocrater), the 62°C submarine thermal water, the fossil sea-cliff, the trachyte lava dome, and the ultramafic xenoliths are worth mentioning (Figure 1).

This site is a formal protected area since 2005 due to its unique geological heritage and its historical, geographical, biological, scenic, and socio-economic importance. This Natural Monument has a high value/use in what concerns science, education, culture and economy (e.g. tourism) (Nunes & Lima, 2009).

The factors that are affecting the relevance of this geosite can be divided into natural and anthropic ones. In the first category can be mentioned the marine and slope erosions. In what concerns anthropic factors, trampling in the littoral cone, vandalism and littering in the viewpoint area, urban pressure on the lava delta and quarry activities in Pico das Camarinhas scoria cone are the most important.

One of the geological features that are being monitored is the littoral cone (or pseudocrater), a very rare landform in the archipelago, highly vulnerable and that is being under increased treat due to trampling, even if this is forbidden according with the protected area regulations. The monitoring includes registration of the number of people that climb the cone and the periodic control of the path changes through marks measurements and photographic control.

The monitoring strategy also intends to characterize how visitors evaluate the contents and quality of the interpretative panel located in the geosite. This evaluation is based on the time that each visitor spends looking/reading at the panel.

Finally, the monitoring strategy aims to produce a visitors' assessment, through two complementary approaches: a) the number of visitors is being determined by direct counting of persons visiting the geosite, 6 hours per day, 70 days dispersed along one year (including the high and low tourism seasons); b) the visitors' profile is being outlined based on data obtained with a short personal questionnaire.

The analysis of the evolution of the conservation status of a geosite plays a very important role in the control of its decline. The decrease of relevance of a geosite could be justified either by direct degradation of a geological feature or by lack of concern in the maintenance of the site by local authorities. Thus, the monitoring of geosites is a very important tool to assure the permanent conservation and so the sustainable use by the public of a given geosite, a policy that the Azores Geopark intends to reinforce in the years to come.



Fig. 1. Pico das Camarinhas scoria cone (a) and Ponta da Ferraria lava delta (b).

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