

# *GEOCONSERVATION IN THE ORDOVICIAN OF PORTUGAL: THE VALONGO PALAEOZOIC PARK, THE GEOLOGICAL INTERPRETATION CENTER OF CANELAS AND THE PENHA GARCIA ICHNOLOGICAL PARK*

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The Valongo Palaeozoic Park, the Geological Interpretation Center of Canelas (Arouca Global Geopark) and the Penha Garcia Ichnological Park (Naturtejo Global Geopark) are three areas of Portugal where geoconservation strategies have been implemented. The two first examples are located in the Metropolitan Area of Porto in North-Western Portugal: the Valongo Palaeozoic Park is placed south of Valongo in the neighbourhood of Porto and the Geological Interpretation Center of Canelas is situated in the vicinities of Arouca; Penha Garcia Ichnological Park is positioned in the NE region of Naturtejo Geopark, in the Centre of Portugal, near the border with Spain. The international relevance of the geological heritage of these three areas provided the earliest approaches on the protection and management for the Ordovician of Portugal. The **Valongo Palaeozoic Park** created in 1998 was a pioneer example of geoconservation in Portugal resulting of the partnership between the Municipality of Valongo and the Faculty of Sciences of the University of Porto. The project started in 1995 and was founded by a European Community LIFE Programme. Since 2000 the Park has the assistance and scientific support of the Geology Centre of the University of Porto. **The geological heritage of Valongo Palaeozoic Park includes significant values with major focus on the Ordovician fossil sites including also ecological values protected under Natura 2000 Network. All this rich heritage have deserved the attention of scientists and** authorities that enthusiastically developed efforts to preserve and raise awareness about the Park (Couto & Lourenço 2005) and which led the Portuguese Group of ProGEO to assign to the Municipality of Valongo the Geoconservation Award 2005. The Palaeozoic Park, as a part of a greater area designated “Santa Justa and Pias Mountain”, was protected as Local Protected Landscape Area by the Municipal Assembly of Valongo in 2010. “Ordovician fossils from Valongo Anticline” was one of the fourteen frameworks proposed by the Portuguese Group of ProGEO to include the Portuguese Geological Frameworks of International Relevance published in Episodes by a working group from several universities and other institutions. In the Interpretative Environmental Centre there are permanent exhibitions, a small library provided with scientific and didactic papers, thematic posters explaining the most relevant geological events, a block-diagram representing the actual geology and geomorphology of the region and its evolution throughout 350 million of years after the structuring of Valongo Anticline. Among the educational activities, observation of fossils and minerals with identification cards is provided. There is also an exhibition of fossils from the region representing the forms of life that inhabited the Ordovician sea of Valongo. The interpretative circuit has three geo-trails (green, red and yellow trails) that show different aspects of the protected geodiversity. **Geological Interpretation Centre of Canelas** launched in 2006 is the most relevant site of Arouca Geopark. This infrastructure was fundamental for the starting up of the Arouca Geopark which became included in the European Geoparks Network in 2009. The activity of the quarries is usually associated to the destruction of fossils, however in

Canelas, the operating company Ardósias Valério & Figueiredo Lda is protecting them carefully since the quarry reopened in 1988 (Sá et al. 2005). These fossils were exhibited in the most prestigious universities and museums since 1994. The Geological Interpretation Centre of Canelas was born as a private project owing to the necessity to create an on-site permanent exhibition. Some of the invertebrate fossils (in particular trilobites) were recovered since the rebirth of quarrying. The most significant fossil collection of the Geological Interpretation Centre of Canelas was the aim of several palaeontological studies. Despite these studies only in 2011 the inventorying of each specimen in a comprehensive database began to be developed with the support of experts and universities. An outdoor educational activity of Geological Interpretation Center of Canelas is the “Palaeozoic Geo-trail”. The **Penha Garcia Ichnological Park** was the birthplace of Naturtejo Global Geopark in 2003, the first Geopark of Portugal. In 2004 the Portuguese Group of ProGEO assigned to the Municipality of Idanha-a-Nova the Geoconservation Award and in 2007 the Geoconservation Award was assigned to the “Associação de Municípios Natureza e Tejo” for the work developed on preservation and raising awareness of geological heritage particularly in Penha Garcia. The Ordovician fossil sites are protected under the municipal frame, and the Ichnological Park is daily controlled by a vigilant. Several fossil sites and “House of fossils” are accessed by the Fossils Trail where visitors find easily beautiful examples of *Cruziana* beds in an outstanding geological setting (Neto de Carvalho, 2004). There are also several educational programs for the Portuguese school curricula where students and teachers can apply what they learn outside the classroom. In all three protected areas a great geodiversity is evident in the Ordovician sequences that show different and interesting values namely in palaeontology (a great palaeobiodiversity with trace fossils and marine invertebrates) and stratigraphy (complete sequences starting from Lower Ordovician, with evidences of the opening of Rheic Ocean, to the Upper Ordovician when these regions were next to an ice cap located in South Pole). Lower Ordovician rocks, namely those evidencing submarine volcanism, and the presence of algae sometimes forming stromatolites and other microbial-induced sedimentary structures, contributed for the concentration of gold that was exploited since Roman times contributing in these areas for a relevant geomining heritage. Geoconservation approaches include also guided visits for schools and to the general public, training for teachers, and national and international scientific meetings. Since 1998, in the frame of “Geologia no Verão” (“Geology in Summer”) an initiative of “Ciência Viva” program and more recently, since 2005, in the frame of “Universidade Júnior” (“Junior University”) an initiative of the University of Porto, several activities have been developed to rise awareness of the geological heritage of the Ordovician of Portugal.

## References

- Couto, H. & Lourenço, A., 2005. The Valongo Palaeozoic Park: Geodiversity and the importance of valuing and conserving the Geological, Palaeontological and Geomining Heritage. In: D. Pereira & P. Pereira (Eds.), *Geology as background for a top-class geological and cultural heritage in the Douro region (Northern Portugal) Field Trip Guide Book, IV International Symposium ProGEO on the Conservation of the Geological Heritage, Braga*, p. 21-55. Plate B
- Neto de Carvalho, C., 2004. Os Testemunhos que as Rochas nos Legaram: Geodiversidade e Potencialidades do Património do Canhão Fluvial de Penha Garcia. *Geonovas*, **18**: 35-65.
- Sá, A., Valério, M., Rábano, I. & Gutiérrez-Marco, J.C., 2005. A paleontological site of international relevance in the Ordovician of Arouca (Central Portugal), and a paradigm for cooperation between science and industry. Abstract of the IV International Symposium ProGEO on the Conservation of the Geological Heritage, Braga, 42.