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COMMENT

Geoconservation and protected areas

Introduction

In most countries, protected area managers are primarily interested in biology (McNeely & Miller 1984; Nelson & Serafin 1997). This perspective is not suitable for effective nature conservation because there is no real separation between geological and biological processes. Geology is important in all kinds of planning projects because geology is part of all natural systems. Understanding of climate, landforms and biodiversity depends on geological studies. Even human habitation and cultural heritage depend on geology. During the last 30 years, numerous studies have shown that biological conservation is essential to the welfare of all human beings. Nevertheless, the concept of geoconservation and preservation of the geological heritage has appeared only recently (Wilson 1994; Sharples 1998; Barettino *et al.* 1999, 2000; Osborne 2000).

I argue that real nature conservation can only be attained if geology is integrated into protected area management at the same level of importance as biology and all natural processes are considered together.

Geodiversity, geological heritage and protected areas

One of the best definitions of geodiversity is given by Stanley (2000): 'Geodiversity is the variety of geological environments, phenomena and active processes that make landscapes, rocks, minerals, fossils, soils and other superficial deposits which provide the framework for life on Earth'. Stanley (2000) emphasized that geodiversity 'is also the link between people, landscapes and their culture through the interaction of biodiversity with soils, minerals, rocks, fossils, active processes and the built environment'. A wider scope for nature conservation policies must be conceived. Wilson (1994) presents earth heritage conservation as '…the maintenance of landforms, natural and artificial exposures of rocks sites where geological processes can be seen in action today'. Geoconservation (Sharples 1998) is a new word that can be used to define initiatives that maintain geodiversity.

Geological heritage is related to the importance of the site (locally, regionally, nationally and internationally), its use (educational, scientific, and recreational), and the need to conserve it (Zagorchev & Nakov 1998; Barettino *et al.* 1999, 2000; Osborne 2000). The importance of geological heritage conservation is already recognized by several international institutions such as UNESCO (URL http://www.unesco.org/science/earthsciences/geological_heritage.htm) and the International Union of Geological Sciences (URL http://www.iugs.org/iugs/science/sci-wgst.htm). In Europe, the European Association for the Conservation of the Geological Heritage, ProGEO (URL http://www.sgu.se/hotell/progeo/), promotes an integrated geoconservation strategy. In spite of this international recognition, the threats to geodiversity are less well known but are as real as those affecting biodiversity (Weighell 2000). Perhaps lack of familiarity with geodiversity is the reason why conservation legislation rarely refers to geological protection (Dingwall 2000).

The World Conservation Union (IUCN) defines a protected area as 'an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means' (URL http://wcpa.iucn.org/pubs/pdfs/WCPAInAction.pdf). Protected areas have always been viewed from a biological perspective (for instance, Harley 1996; Nelson & Serafin 1997; Bibelriether 1998). The IUCN World Commission on Protected Areas (WCPA) shows the same tendency; not a single word is said about geological heritage in their recent booklet about what has been achieved between 1996 and 2000 (IUCN 2000). The WCPA short-term action plan and the Programme on Protected Areas planned for the period 1999–2002 (URL http://wcpa.iucn.org/pubs/pdfs/st_actn_plan.pdf), maintain the policy of ignoring geological issues in conservation policies. During the last WCPA 2000 meeting, six programmes were

proposed for development between 2001 and 2004 (URL http://wcpa.iucn.org/pubs/pdfs/AmmanMemb_Mtg.pdf); geological concerns were not expressed in a clear way, although there was room to include them in some programmes.

In spite of the unquestionable geological interest of American national parks, 'geology has often been inadequately accounted for in park planning, facility design, visitor safety, resource management, and visitor education' (National Park Service 2001). Nevertheless, protected area management plans of some countries such as those of Scotland (Grant 1999), Canada (Cline *et al.* 1984) and England (Weighell 1999) recognize the importance of geology. The main reason for classifying the Niagara escarpment in Ontario, Canada as a protected area was its geology (Varangu 1997). In Portugal's territory there are five natural monuments with geological relevance (the occurrence of dinosaur footprints), but no natural park is dedicated to geology. In recent years, an effort has been made to study the geological background of Portugal's natural parks. For example, a project is under development in the two natural parks of north-east Portugal (International Douro Natural Park and Montesinho Natural Park) with the goals to:

(1) Create scientific instruments to support a sustainable management of the resources and territory, making geological, geomorphological, and geological resources mapping and guidebooks available;

(2) Inventory and characterize the value (scientific, pedagogical, recreational) and relevance (local, national, international) of geosites; and

(3) Increase the public awareness of earth heritage conservation producing informative web pages, interpretative panels, geological booklets, and by training natural park staff.

Geoconservation and the public

Public awareness of nature conservation is dependent on the scientific background of the public. Unfortunately, even in developed countries, many people have a limited exposure to science and technology subjects. According to a recent survey conducted by the European Commission (URL http://europa.eu.int/comm/dg10/epo/eb/eb55/eb552_sctech_en.pdf), 45% of Europeans feel that they are neither interested nor informed about science and technology and two-thirds consider themselves uninformed. The public's understanding of science is essential for the effective implementation of conservation policies. Harley (1996) showed that, in England, the involvement of local people in geoconservation management is important in the implementation of conservation policies.

Protected areas offer an opportunity for environmental education (for instance, Markovics 1996; Biderman & Bosak 1997). In Portugal, during the last four years, I guided several field trips in Peneda-Gerês National Park; the participants expressed interest in learning about geology even without a solid scientific background. Each year, the Portuguese Ministry of Science and Technology sponsors guided visits for the general public in a very successful initiative called 'Geology in the Summer'. These kinds of initiatives raise public awareness of the need for a holistic approach to nature conservation that includes geology.

Final considerations

Conservation will fail if nature conservation policies impose artificial boundaries on the natural world. The protected area manager's main task is biodiversity preservation. Nevertheless, nature conservation requires a broad perspective. Incorporating geology into conservation policies at the same level as biology is urgent. The slow rate of many geological processes leads to the misconception that geological resources are inexhaustible and immutable. Geologists know that this is not true and that many landscapes and outcrops with unique features have already been destroyed forever due to an inappropriate management.

Protected areas should be used to increase public awareness of all aspects of nature. The perspective that people visiting protected areas want to know more about plants than rocks is not true. Many visitor centres have dozens of leaflets about the area's trees and animals but lack any information about geology. The lack of geological information can be partially explained by the attitude of geologists. Until recently, geologists were not trained to communicate with non-geologists. Geology is often obscured by technical jargon, and geological processes require

millions of years, which constitute an incomprehensible time span. An example of the difficulty of relating geology to large audiences is the limited number of TV shows dedicated to geological themes, in contrast to the hundreds of TV shows about wildlife broadcasted all over the world.

This situation must be turned around to increase the public's understanding of geology. Raising the importance of geological content in undergraduate teaching, implementing life-long learning for park rangers and conservation technicians, among many other possibilities, should be a priority for geological associations and societies. Protected area managers should promote geological information with traditional leaflets and books, and with new multimedia products distributed on the Internet and CD-ROMs.

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