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Geosites inventory of the Abruzzo Region (Italy)

R. Massoli-Novelli, E. Burri, M. Petitta

Dipartimento di Scienze Ambientali, Università dell'Aquila, 67100 L'Aquila - Italy

Abstract: An inventory of the many geosites of the Abruzzo Region is discussed. There are two main geological districts in Abruzzo: the Central Apennine Mesozoic-Cenozoic limestones, and the Flysch basins toward the Adriatic coast. The inventory considers about 200 geosites and is based on a comparative assessment method. Criteria for the selection of geosites are based on the same characteristics proposed by ProGEO Europe and ProGEO Italy.

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Introduction

The Abruzzo Region contains a large number of important geological sites, mainly within sedimentary, tectonic and geomorphological settings. According to the recent ProGEO Italy subdivision (Benvenuti et al., this volume), Abruzzo comprises two of the main Italian districts: the Central Apennine Mesozoic-Cenozoic limestones, and the Flysch basins toward the Adriatic coast.

The first attempt at a regional inventory, with only 50 geosites, was performed a few years ago (Massoli-Novelli et al., 1996). Today, after new research and national/international co-operation, our Group has initiated a two-year project aimed at the creation of a detailed regional geosite inventory, which is necessary for the conservation of our regional Geological Heritage.

Reference to regional legislation

The geotopes census was initiated by the Abruzzo Region in relation to the provisions of article 56 of Regional Law no. 18 of 12.04.1983, which established "Norms for the conservation, protection and transformation of the territory of the Abruzzo Region". For the execution of activities related to urban and territorial planning, this law necessitates the collection and cataloguing of documents concerning use of the land, as well as an inventory of the environmental and historical patrimony. A further motivation to perform such a census derives from article 25 of Regional Law no. 38 of 21.06.1996 "Statutory Law on Protected Areas of the Abruzzo Region for the Apennine Park of Europe". It contemplates "Regional Natural Monuments" for which is foreseen the possibility of a classification and a direct protection imposition; important geological formations are expressly indicated in this category.

It should be stated that the investigation and cataloguing of the biological patrimony (botanical and zoological) is rather advanced, also in light of a strong national tradition, whereas similar work on the geological heritage is only in the initial stages. It is sufficient to remember the "BioItaly" and "Nature 2000" censuses carried out in 1996-97, financed by the Ministry of the Environment and the European Community. These detailed and complex lists have subsequently been used to compile a special list, called Sites of Community Interest (SCI), which includes the areas of greatest environmental value.

At times the decision about the boundaries of an area to be protected ignores its geomorphological characteristics and depends almost exclusively on the biological value of the site. Indeed, in the case of sites with a predominantly karstic morphology, the blowouts are included but not the pot-holes, or vice versa (Butters, 1989).

The geosites census in progress will allow those in charge of territorial planning and the management of Parks and protected areas to obtain a list of sites with recognised geological and environmental value, so that they can then proceed with the necessary conservation initiatives.

Criteria of the regional geosites inventory

Methodological problems in the selection of geosites have been discussed since the 1980s in light of national/international activities in the area of geological heritage conservation (Anderson et al., 1990; VV.AA., 1991; Arnoldous et al., 1995; Wimbledon et al., 1996).

On the basis of the experiences of many working groups, the fundamental methodological criteria applied in this research for the Abruzzo geosite inventory are:

1 - Representativeness
2 - Scientific interest
3 - Rarity
4 - Scenic value
5 - Educational value
6 - Accessibility
7 - State of preservation
8 - Vulnerability.

Other important data are:

9 - Presence or absence of geological information
10 - Association with non-geological interests (historical/cultural, archaeological, botanical, zoological, etc.)
11 - Area management/protection level
12 - Availability and proposal for conservation.

Regional geosite inventory

The Abruzzo geosite inventory is currently based on seven main geosite groups, each related to a different geological origin. The seven main groups are:

- geomorphology;
- stratigraphy;
- tectonic;
- mineralogy and petrography;
- hydrology and hydrogeology;
- palaeontology;
- pedology.

Each group provides a framework of the site's geological character. Moreover, each group contains two or more types, with the aim of obtaining a more detailed inventory.

Geomorphological Sites	Erosional
	Canyons
	Karst
	Glacial
	Landslides
Stratigraphical Sites	Mesozoic
	Cenozoic-Quaternary
Tectonic Sites	Faults
	Folds
Mineralogical/Petrographical Sites	Scientific interest
	Economic interest
Hydrological/Hydrogeological Sites	Springs
	Rivers
	Lakes
	Falls
Palaeontological Sites	Vertebrates
	Invertebrates
	Vegetation
Pedological Sites	Palaeosoils

The inventory form used for our census was prepared on the basis of the investigations of ProGEO Europe/ProGEO Italy and on previous inventories of the Abruzzo Region (BioItaly, Natura 2000, Piano Regionale Paesistico). In this detailed three-page form, for each geosite a value is assigned to the five most important criteria after a comparative assessment (value 0-3, for a total of 15). In the end, we hope to have a numerical basis on which to classify the regional/national/international importance of our geosites.

The Abruzzo geosite census has not as yet been completed. To date, the inventory database includes 180 geosites and we expect to reach a maximum of 200 sites. This means that we have collected 90% of

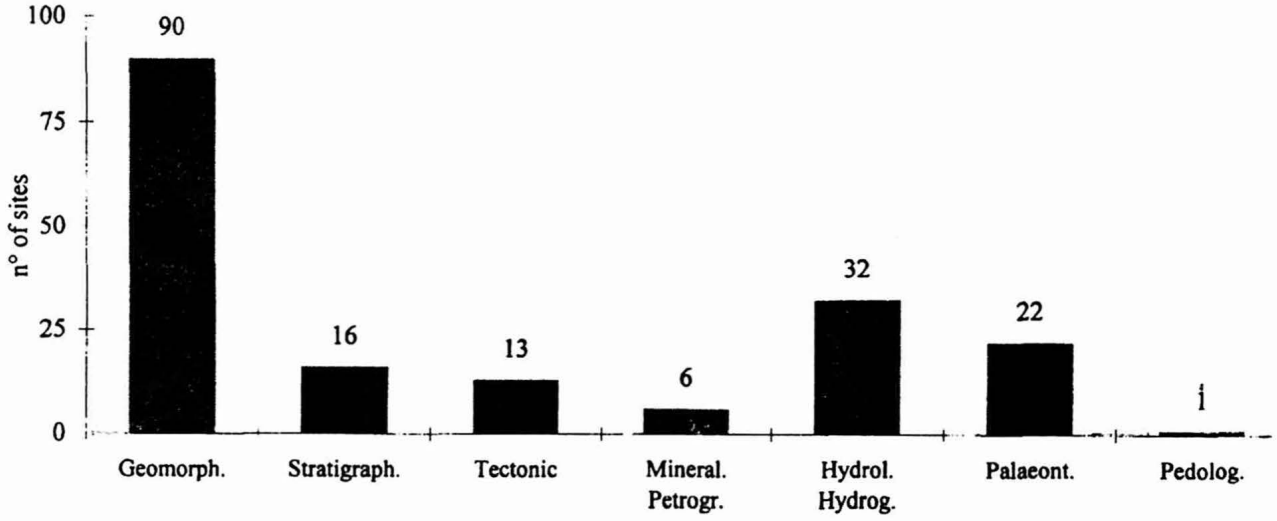

Fig. 1. Groups of the Abruzzo geosites (total n. 180)

the data and thus it is possible in this paper to discuss preliminary results.

The number of sites for each of the seven main groups is related to two fundamental parameters:

1) The general geology of Abruzzo, with an abundance of carbonate rocks and a virtual absence of igneous/metamorphic complexes. This means very few ore and mineral sites, whereas many sites are related to karstic and carbonate phenomena.

2) The philosophy of the inventory, decided on together with the Abruzzo administrators, is to introduce the general public to the Earth Sciences and to promote geoconservation. Consequently, there are many geomorphological and picturesque sites.

Most of the geosites (50% of the total, 90 geosites) belong to the "geomorphological" group. This is due to their great scenic value and to the high proportion of karstic and erosional types.

"Hydrological/hydrogeological" sites are well represented (18%). Water represents a fundamental element of the geological and environmental setting of Abruzzo. The abundance of springwater gives rise to a large number of important environmental areas, with typical faunal and vegetational features. These elements contribute to the large number of protected areas in Abruzzo.

Among the geosites, we have identified many palaeontological sites (12%), particularly important for vertebrates. Stratigraphical sites make up 9% of the total and include interesting lithological variations, beddings, unconformities, etc.. Tectonic sites are also present, with very important faults and folds (7%).

The "mineralogical/petrographical" (3.5%) and "pedological" sites (0.5%) are less important, although searches are in progress for sites in these categories. However, the small number of "mineralogical/petrographical" sites is also due to the geological setting of Abruzzo, with a virtual absence of igneous and metamorphic rocks. Indeed, sedimentary rocks present little interest for mineralogy.

The number of sites in the sub-categories are very heterogeneous. In the "geomorphological" group, karstic sites (51) are most numerous, due to the abundance of carbonate rocks in Abruzzo. We also have many erosional (15) and glacial (14) sites. Erosion landscapes and canyons (9) are numerous because the Abruzzo mountains are very young. Glacial features are typical of the major Apennine peaks in Abruzzo. Only three landslides are included in the inventory, although they represent the recent evolution of the Abruzzo territory.

The "hydrological/hydrogeological" group contains 15 important springs (related to the geological features of the many carbonate mountains in the region), 9 falls, 5 lakes and 3 river areas. All of these sites are associated with protected areas and/or high-value environmental zones.

The site distribution shows a large number of them in the mountainous areas (L'Aquila 40%, Teramo 25%) and few sites in the coastal areas (Chieti 18%, Pescara 15%).

A final statistical remark: 40% of the 180 geosites are included within protected areas of Abruzzo. This will facilitate the conservation and future improvement of those sites. However, for increased knowledge and protection of the geosites located outside of protected areas, new legislative measures are required.

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PLATE I

Fig. 1. Parco Nazionale Gran Sasso: Corno Grande (m 2.912), the highest peak as of the park as of the Apennine chain. It is observed from the Campo Imperatore (m 2.200) karstic lake. *Photo by R. Massoli-Novelli.*

Fig. 2. Castel del Monte strike-slip fault, in Mesozoic limestones. Abruzzo shows the most evident faults (NNW-SSE) in the Central Apennines: they continue to move. *Photo by R. Massoli-Novelli.*

PLATE II

Fig. 1 - Parco Nazionale Maiella: on the left, at an elevation of m 2.500, the Murelle fault, on the right down the Murelle canyon. *Photo by R. Massoli-Novelli.*

Fig. 2 - Sassa (L'Aquila) palaeontologic geosite: Medium Pleistocene vertebrates (Elephant, Rhino, Hippo, Megacerinos, etc) excavation. *Photo by R. Massoli-Novelli.*

PLATE I

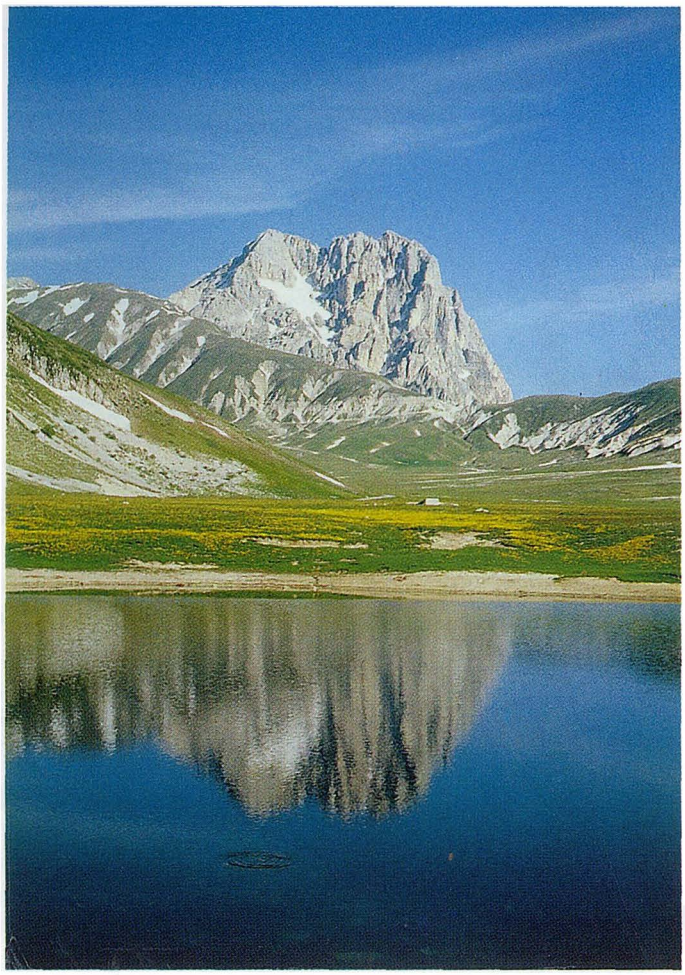

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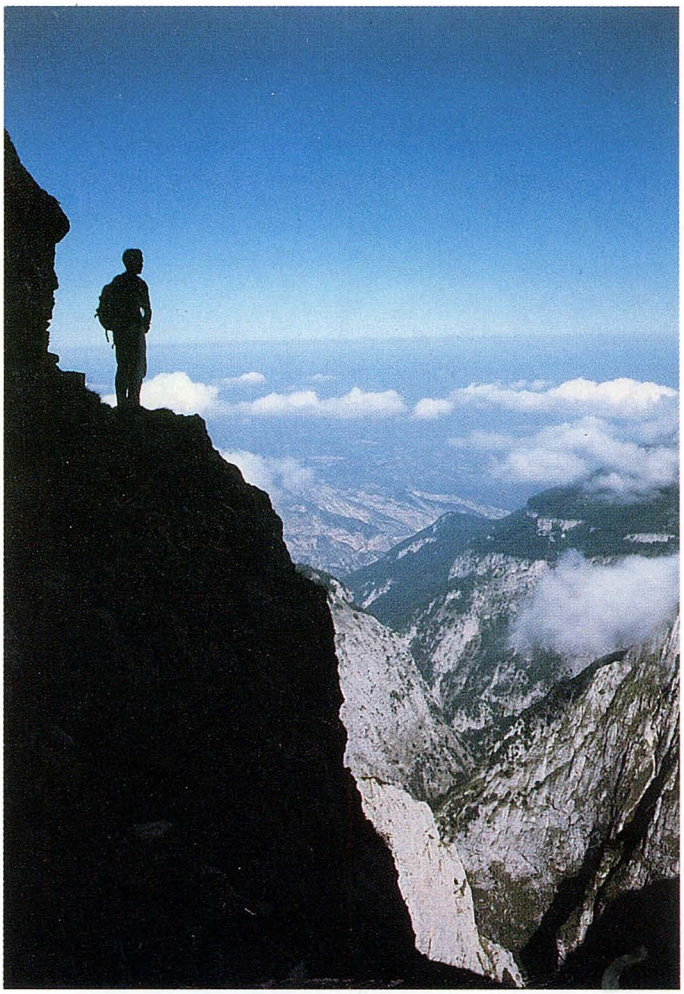
PLATE II



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