

Geomorphosites and the conservation of landforms in evolution

Geomorfositi e la tutela di forme del rilievo in continua evoluzione

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ABSTRACT – Geomorphosites are in continuous evolution. They are developing forms constantly attempting to reach a temporary equilibrium depending on the current morphoclimatic regime. The dynamicity of the geomorphosites poses practical and theoretical issues as regards to the management of such sites. In fact, if these forms are in evolution is it right to set about conserving a stage of that evolution? Moreover it is difficult to conserve with current rigid legislative procedures a dynamic element such as geomorphosites, their ongoing evolution poses problems for our system of limits, which are essentially based on geometrical considerations. Nevertheless, the dynamicity of geomorphosites represents an extraordinary tool for education, to fully understand and interpret the landscape and its complex equilibria.

KEY WORDS: Conservation, Geomorphosite, Landscape Evolution.

RIASSUNTO – I Geomorfositi sono forme in continuo divenire, alla ricerca di un equilibrio precario dettato dalle condizioni morfoclimatiche. La dinamicità di questi beni ambientali pone dei problemi teorici e pratici alla loro salvaguardia e gestione. Dal punto di vista teorico, infatti, se i geomorfositi sono forme in continua evoluzione ci si può domandare se sia giusto adoperarsi per conservare uno stadio dell'evoluzione, impedendo la formazione di quello successivo. Dal punto di vista pratico, la dinamicità di queste forme mette in crisi i rigidi sistemi normativi nazionali, che si propongono di tutelare i beni attraverso perimetrazioni e zonizzazioni rigide, poco adatte alle dinamiche naturali. Tuttavia proprio la dinamicità dei geomorfositi, opportunamente valorizzata, può assumere un ruolo fondamentale nel far comprendere la continua evoluzione del paesaggio e ciò che regola i suoi complessi equilibri.

PAROLE CHIAVE: Conservazione, Geomorfositi, Evoluzione del Paesaggio.

1. – INTRODUCTION

Geomorphosites (PANIZZA, 2001) are landforms of the physical environment in continuous evolution, constantly searching for an equilibrium that is by definition temporary. It is precisely this characteristic that poses both practical and theoretical problems as regards the management of such sites, but which at the same time represents an extraordinary tool for environmental education.

It is within this context that geomorphosites, thanks to their dynamic nature, can assume a very important role in transmitting the concept of the continuous state of flux of the earth's surface, with all the possible implications that this presents.

2. – A CONCEPTUAL PROBLEM: WHAT TO CONSERVE

In the management of geomorphosites we must face a conceptual issue as to the identification of what landforms to protect and conserve. In fact, if these forms are in evolution is it right to set about conserving a stage of that evolution, in this way obstructing the possible successive phase of development? Given this premise, what stage should be conserved? How should we behave when faced with morphologies that are no longer in equilibrium with current morphoclimatic con-

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ditions? So the very question is what to conserve.

If, sometimes, due to scientific interest, it is useful to preserve a relict form, on the other hand we run the risk of producing “a fossil landscape” at the moment that we hinder its current evolution (FEDERICI, 2003). This issue is difficult to define and does not only regard environmental resources, but is equally applicable to cultural resources (strictly speaking) which always pose problems in Italy concerning the issues around the conservation of environmental resources.

In the field of cultural resources and particularly those regarding architecture, the issue of what it is right to conserve has deep roots and has been faced at least since the beginning of the 1800s with the origin, overlapping and often conflicts, of the various theories of restoration. Without going into the relative merits of individual theories, from that of stylistic restoration (1), up to the current lively debates on the opportunity or otherwise of preserving the historical centres of towns from the influence of modern architecture (2), it can be observed that historically the need to conserve important historical, social and artistic values, has made it legitimate to reconstruct buildings that had been entirely destroyed, following the diktat of the ancient formula of “how it was and where it was”.

This is the case, for example, of the Santa Trinita bridge in Florence, destroyed by German mines on 3 August 1944 (fig. 1). There was lively debate as to whether there should be a faithful reconstruction with original materials or a completely modern and newly conceived architectonic structure. In the end the former project won the day, its supporters convinced that they were returning to the community the old bridge that belonged to the city. In this case it is the idea of “bridge”, patrimony of the collective memory, which prevails over other considerations. Beyond the obvious differences of history, approach and culture, it is probably precisely this concept of identification of the community with the resource that represents a precious element to take into account also in the management of environmental resources such as geomorphosites (WIMBLEDON *et alii*, 1999).

In the field of environmental resources, however, the complexity of the issue in question is greater. Not only is there a more limited histori-



Fig. 1 – The Santa Trinita bridge in Firenze.
– Ponte di Santa Trinità a Firenze.

cal-cultural background involved, but there is also the fact that man is intervening in something that does not belong to him, of which he has less knowledge and over which he has less power of action. In identifying what to conserve there are undoubtedly absolute priorities. These often involve the safeguarding of elements of high scientific interest, unique and unrepeatable evidence of particular events, key points for the understanding of the geomorphological history of an area, for which, as far as is possible, it is worthwhile exerting pressure in order to conserve the resource.

In the Apuan Alps the morainic ridges, sporadic evidence of the last glaciation, are well worth attention even though they are no longer in equilibrium with the current morphoclimatic regime, and therefore an attempt at conservation should be made. This operation would certainly not preclude their possible evolution under the present morphoclimatic situation, for example through landsliding. However, it should safeguard these landforms against the marble mining activity of the area, which eats into the glacial cirques, takes away the rare erratic masses (MASINI, 1970) and destroys the roches moutonnées (fig. 2).

Besides the basic concept of safeguarding these features of high scientific interest, there are no pre-established solutions as to what it is right to conserve, but rather solutions that vary according to the **historical** and **cultural context**. Similarly to what happened regarding the Santa Trinita

(1) The origin of stylistic restoration can be traced to the chirograph of Leone XII in 1825, in which it is established (concerning the reconstruction of the Basilica of San Paolo Fuori le Mura in Rome) that “no innovation must be introduced in the architectonic forms and proportions and none in the ornamentations of the new building, unless this is to exclude a thing introduced after its first foundation purely for the fancy of the following age.”

(2) We should not forget that also the historical centres as they have arrived to our day are very much the result of a stratification of events and often the result of violent intervention like for example the demolishing of pre-existing districts (eg. Altare della Patria in Rome). Note how European operations like the Louvre Pyramid and national projects like the Infobox le Gocce, by the architect Cuccinella have caused very mixed reactions depending on the differing degrees of identification of the general public with the new work.

bridge in Florence, in the choice of what to conserve we need to take into consideration what has become an integral part of the life and identity of the local community.

It would never enter one's mind to conserve a waste dump. However, in the Apuan Alps, the *ravaneti* (fig. 3), which are nothing more than residual marble quarry deposits, assume such an importance as to be conserved as resources in that they are a distinctive landscape feature that is typical of the history and culture of the area (D'AMATO AVANZI & VERANI, 1997; BARONI *et alii*, 2000).

It is the historical-cultural context, in this case, which typifies the resource to conserve. It is the long history of more than 2000 years of quarrying activity, typical of the Apuan Alps, which turns the *ravaneto* from a mere waste deposit into a resource. It is sufficient to shift geographical context and move for example across to the nearby Pisan Mountains, where similar landforms lose their significance and are considered a common quarry waste deposit of no interest whatsoever.

An equally typical example of conceptual evolution in terms of geoconservation is that of the very varied behaviour of man towards wetland areas. There are several examples in Italy of districts involved in the first reclamation projects of the Romans, or those carried out in the 20th century, today legislatively safeguarded as the habitats of protected species (Habitat directive 43/92CEE). There are clear examples of very different behaviour, in the regions of Lazio and southern Tuscany, for example the mouth of the



Fig. 3 – The residual marble quarry deposits as a typical element of the Apuan landscape.
– *Ravaneti delle cave di marmo, elemento tipico del paesaggio delle Apuane.*

River Ombrone reclaimed many times and today a protected wetland and site of the nature reserve of Diaccia and Botrona. A smaller, but equally significant, example is in the Apuan area, between the south-western limit of the Apuan Alps and the Tyrrhenian Sea, where there are some wetland sites classified as Sites of European Community Importance (FEDERICI, 1998). In particular there is Lago di Porta (today dry) and the Lake and marshland of Massaciuccoli (fig. 4).

A final example is the relict of a series of wetlands that originate along the Apuan-Versilia coastline, caused by the isolation of waters produced by the barrier effect of sand-banks introduced after the Versilia Transgression (SESTINI, 1950; FEDERICI, 1983; MAZZANTI *et alii*, 1990). This area has a complex history which has seen man constantly intervene over the centuries with reclamation operations, (from the Etruscan-Roman period, to the Middle Ages, the Renaissance, and later in the centuries of the great reclamation schemes and even up until the immediate post-war period). In this way the landscape we see today is very much the result of a natural environment strongly influenced by man (FEDERICI, 2003). Over the years the relationship of man with this environment has changed, but particularly from the 18th century there has been a prevailing philosophy of human intervention in order to eliminate the stagnant inland waters, and in this way most of the wetlands have disappeared. In particular, in 1900 the district of Massaciuccoli was classified as a 1st category reclamation area. From 1927 on various water consortia were founded and the reclamation process became very much a systematic development. Today, despite the clear need to maintain active the reclamation schemes, which have made the area habitable, attention has shifted to safe-



Fig. 2 – Roches moutonnées in the Orto di Donna valley (Apuan Alps, Tuscany): evidence of the last glaciation. Historical (photo by Domenico Zaccagna Accademia di Belle Arti di Carrara).

– *Rocce montonate nella valle di Orto di Donna (Alpi Apuane, Toscana): evidenze dell'ultima glaciazione (Fotografia storica di Domenico Zaccagna, Accademia di Belle Arti di Carrara).*

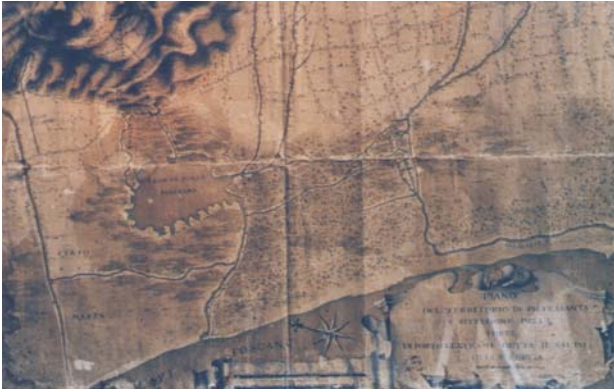


Fig. 4 – Historical map of Porta lake (named Beltrame) (Tuscany).
– *Carta storica del lago di Porta (chiamato Beltrame) (Toscana)*.

guarding the wetlands and the Lake of Massaciucoli and ex Lake of Porta are protected as Sites of Community Interest due to the rarity of their natural habitats.

3. – A PRACTICAL PROBLEM: MANAGING LANDFORMS IN EVOLUTION

Apart from issues of a conceptual sort, there are various practical problems associated with the management of geomorphosites. In fact, complicating the already difficult situation of their management is also the often inadequate Italian national legislation, which uses a very limited classic conservational model, based on a static and mummifying idea of conservation (POLI, 1999).

As reported in the European Landscape Convention (adopted in Florence on 20 October 2000) one of the most important item to obtain the safeguard of sites is the public promotion of their scientific value. This is patently unsuitable when dealing with a dynamic reality like that of the natural environment. It is difficult to conserve by means of rigid normative systems a dynamic feature such as a dune, the wandering of a river course, the incision of a gully or an active moraine. Their ongoing evolution hinders our typical systems of protection, which are unable to adapt to natural dynamics because the norms have been designed on the basis of strict measurements and zoning which are in turn associated with equally rigid legislative rules and regulations.

A river, for example, continually changes its course with slow and gradual transformations, such as the migration of its meanders or shifting of sand bars. Furthermore, following a flood event it can change its course very suddenly and begin flowing in a new bed and can, for instance, fan out into an alluvial cone. In this case, having to adjust

the legislation so as to create diversified zones of protection relevant to the new course of the river is a difficult and laborious operation. There are cases in which water courses with their movements, be they gradual migrations or sudden variations, flow beyond the area that is administratively identified as a floodable district with a return time of 30, or even 200, years (fig. 5). It is clear that the legal norms associated with these measured limits lose both value and significance.

On the other hand, establishing that a natural feature is a geomorphosite does not necessarily mean subjecting it to specific limitations of use. Often the geographical conditions in which the resources are located are a guarantee of protection. It is sometimes necessary to focus attention on transmitting the inherent value of the resource because if this is universally shared then it can become a resource for the community in which it is located (BRANCUCCI & BURLANDO, 1998). This is the case, for example, of a little known geomorphosite connected with the glacier of Schiantala in the Maritime Alps.

During the Holocene, the Schiantala glacier has been present in the uppermost part of Vallone del Piz a lateral tributary of Valle Stura di Demonte in the Maritime Alps (fig. 6). Recently, in the cirque forefield of this glacier, thaw process involving glacialigenic debris led to the formation of a glacial karst lake (FABRE & RIBOLINI, 2006). Although of the Schiantala glacier was never declared extinct, neither ice outcrops nor ice/snow patches are visible in the valley late in the meltout season. From the downvalley edge border of the glacial karst lake a huge rock glacier flows reaching the hollow

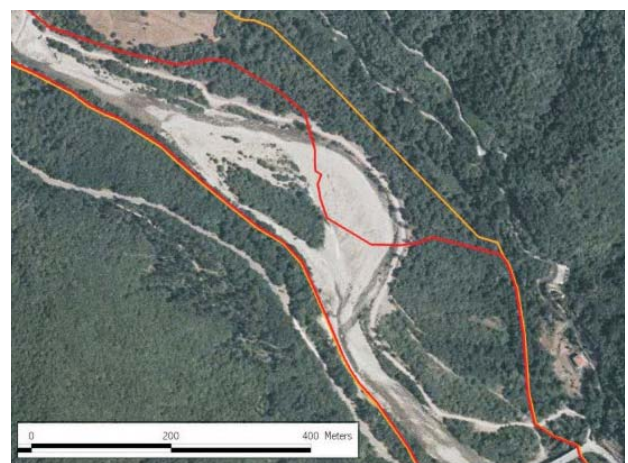


Fig. 5 – The example of the areas of diversified protection and new course of the Vara River (Liguria, Italy). Legend: Red: Floodable area with return time of 30 y; Yellow: Floodable area with return time of 200 y.
– *Esempio di aree a diversa protezione con indicazioni del nuovo corso del fiume Vara (Liguria, Italia). Legenda: rosso, area sondabile con tempo di 30 anni; giallo, area sondabile con tempo di ritorno di 200 anni.*

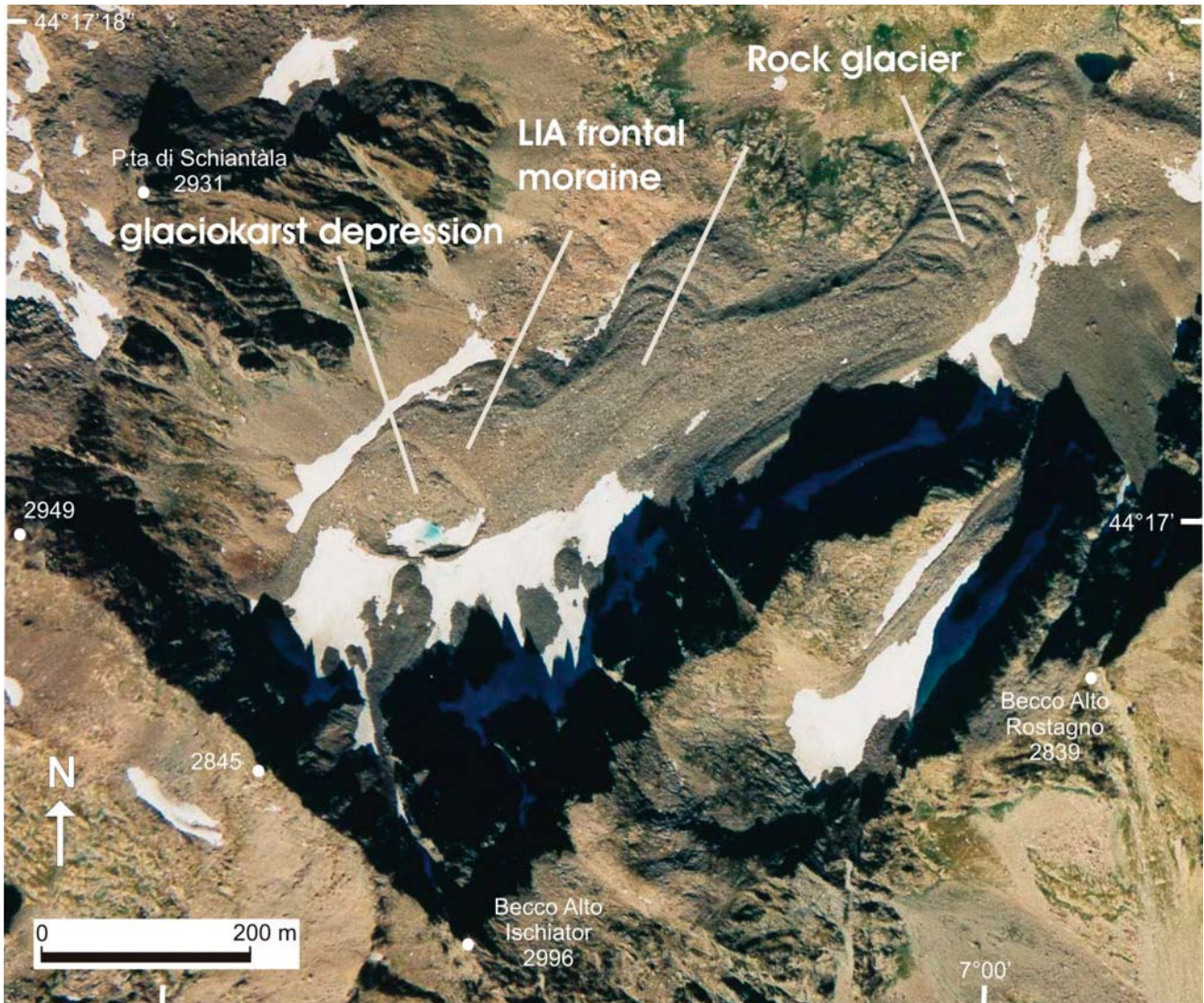


Fig. 6 – The till in the Schiantala cirque floor presently displays geometrical continuity with a huge rock glacier.
 – Il deposito morenico sul fondo del circo glaciale Schiantala mostra continuità geometrica con un rock glacier di grandi dimensioni.

invaded by the Schiantala glacier during its maximum Holocene expansion. In the Schiantala Valley cirque a debris covered glacier was present in the late 1920s. Downvalley its most recent frontal moraine (Little Ice Age) stretches a well developed rock glacier. A remarkable lowering of the debris surface has been taking place during the last 70 years, due to ice melting and the glacial karst lake opened up in the middle of the cirque, showing, under the main debris cover, an ice lense very rich in debris layers. Today there is not evidence of glacial processes: rockfalls from the cirque wall and wings shelter the ice body, and permafrost creeping affects debris mantling the cirque floor and sides.

Recent geomorphological analysis and electrical resistivity tomography (BIANCHI *et alii*, 2004) have highlighted that in the Schiantala cirque the

resistivity values of the ice bodies are very similar to those measured on the exposed ice in another site in the Maritime Alps (the Maledia cirque, in the Gesso valley). Approaching the Little Ice Age morain resistivity values gradually decrease, becoming consistent with ice progressively richer in debris. This suggests that the Schiantala cirque can represent a possible step in the glacial extinction process in which the Maritime Alps glaciers are involved (FEDERICI *et alii*, 2005). The Schiantala area is important as a geomorphosite because it represents the unique example of outcrop of massive ice buried by debris in the Maritime Alps, highlighting a possible style of glacier extinction process in this alpine region. In fact, this site represents significant example of the transformation from clean glacier to debris covered glacier, in analogies with the tendency of the other glaciers in the Maritime

Alps. Moreover the geomorphosite of Schiantala offers the opportunity to infer about the possible role of “glacial ice” in rock glacier formation.

4. – CONCLUSIONS

For an interpretation of the landscape and the understanding of its complex balances the most important thing to conserve and transmit is probably not so much a stage, but the concept and significance of the evolution of the earth. This fundamental phase enables the general public to expand their knowledge of natural phenomena, to understand their significance and their overlapping and interaction with the life of man. One of the many examples of the absolute lack of understanding of the evolution of the physical environment is that of the case of the repeated rockfalls that occurred in the Dolomites in the summer of 2004. The falls caused a great deal of public concern regarding the state of the mountains, almost as if they were about to disappear from one moment to the next. There was great speculation as to the reason for the phenomenon, drawing into the debate climatic changes

and blaming man for his inconsiderate actions. In effect, however, the disintegration of the rocks is very much an aspect of the natural evolution of the mountain chain. It is a natural evolution not difficult to understand, as witnessed by the presence of the numerous detritic layers that surround the main Dolomitic peaks (fig. 7).

Therefore, it is important to transmit, by means of geomorphosites (in this case for example: detritic layers, cones, debris flows) how a mountain chain is formed, how long it has taken for its deposits to emerge from the ocean in which they formed, in order to become the peaks we know today, and which make up the skeleton of our landscapes. Furthermore, it is equally important to understand that what we see today is not the final frame of the film of the land, but only one of the frames in between. The engine of evolution that has brought a land to us in its present form has not stopped. The very same landscape will continue to evolve, and a mountain chain subject to the action of exogenous agents will be stripped down to the point where it becomes a plain and very possibly a new sea. It is therefore clear how the recent proposal to nominate the Dolomites as



Fig. 7 – Debris cones and talus scree on M. Paterno and Tre Cime di Lavaredo.
– *Coni e falde detritici del M. Paterno e delle Tre Cime di Lavaredo.*

a world heritage site of UNESCO will certainly safeguard the mountains from an environmental point of view, will undoubtedly enable a greater and more effective sustainable development, but it will not preserve them from their natural physical evolution.

By means of suitably exploited geomorphosites, it is possible to understand that geology is a story with a various and extensive chronology. Like history, also geology can be considered “Magistra vitae”. It not only gives indications as to the past, but thanks to the evidence of the past it acts on the present and is able to “foresee the future”.

The most glaring example of how this function of geology is unfortunately not recognised is that of extensive building on the slopes of volcanoes mistakenly believed to be inactive. Man often shows that he has little historical memory, but blatantly shows that he has absolutely no form of geological memory. If on the slopes of Etna, which has experienced eruptions only very recently, we come across the ongoing construction of new buildings, the case of Vesuvius is even more alarming. The long period of inactivity of the volcano has for the most part been interpreted as extinction, and building activity, not only the illegal construction, has proceeded unopposed almost right up to the very rim of the Somma crater. At the present time more than 700,000 people live on the slopes of the volcano. And still a great number of tourists visits the famous archaeological sites of Pompeii and Herculaneum every day, touching directly the history of this land devastated by repeated eruptions. This information that the tourist gleans, just like the solid patrimony of scientific knowledge that we have concerning the volcano, seem to have no effect on daily life. The first remains limited to the one-off experience of the tourist visit, the second only to the scientific community. Considering the great catastrophes of the past, be they floods or eruptions or whatever, seems to condition us into thinking that these events cannot be repeated, despite the continuous demonstration from various parts of the earth that the opposite is true. Geomorphosites could assume, precisely in this way, an important educational role, transmitting the message that what is often simplistically represented by the media as an “extraordinary event” is in reality nothing of the sort, and that some natural disasters are the result of our incapacity to take into account the evolution of an active and dynamic planet.

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