

GLACIAL LANDFORMS IN THE APUAN ALPS (TUSCANY- ITALY): FEATURES IN DANGER OF EXTINCTION

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ABSTRACT: M. Bini, *Glacial landforms in the Apuan Alps (Tuscany - Italy): features in danger of extinction.* (IT ISSN 0394-3356, 2005). The remaining glacial landforms of the Apuan Alps are of great scientific interest, but they are not adequately exploited, and even their very conservation is in peril, despite the protective limitations imposed by the Regional Park of the Apuan Alps. From a first analysis of remaining glacial landforms, two sites in particular have been identified as being worthy of special attention, for different reasons: the Arni moraine and the glacial complex of Campocatino.

RIASSUNTO: M. Bini, *Forme glaciali delle Alpi Apuane (Toscana-Italia): elementi a rischio di estinzione.* (IT ISSN 0394-3356, 2005). *I resti glaciali delle Alpi Apuane hanno un grande interesse scientifico, ma non sono adeguatamente valorizzati, e addirittura è messa in discussione anche la loro conservazione, nonostante i vincoli imposti dal Parco delle Alpi Apuane. Da una prima analisi dei resti glaciali apuani, sono emersi tra gli altri due siti che meritano per ragioni diverse una particolare attenzione: la morena di Arni e il complesso glaciale di Campocatino.*

Keywords: Apuan Alps, Glacial landforms, Geomorphosites.

Parole chiave: Alpi Apuane, Morfologia glaciale, Geomorfositi.

1. INTRODUCTION

The glacial landforms of the Apuan Alps, dating to the last climatic change of the Pleistocene, deserve attention due to their importance in palaeogeographic reconstructions and for the study of glacial processes in the Apennines. It is particularly interesting to look into the reasons governing the extension of the Apuan glaciers given the altitude of the chain, no higher than 2000 m, the short distance from the sea (10-15 Km) and its latitude (44°N) (Fig. 1).

The Apuan glacial remains have very interesting characteristics. In fact, in the Apuan chain there are the lowest deposits in the whole of the Apennines. The reasons for this are probably to be found in the particular climatic regime of the area, above all its high rainfall, which at the high altitudes reaches 4000 mm of rain per year. This seems to have favoured the formation of glacial deposits at low altitudes. The Würm period of permanent snowcover in the Apuan Alps has been calculated for the internal areas at around 1200-1300 m and this is the lowest recorded in the Apennines chain (Braschi *et al.*, 1986).

Palaeogeographic reconstructions have shown that during the last glaciation, on the north eastern sides of the Apuan Alps there must have been at least 9 glaciers, which extended down as far as the Garfagnana piedmont plain. In particular, by 1912 Merciai had already identified the presence of the fol-

lowing 9 glaciers: those of Orto di Donna, Gramolazzo, Pisanino, Campocatino, Tambura, Arni, Altissimo, Corchia and Pania Secca, all on the eastern side. Various traces indicating small glaciers on the seaward side were also found (Federici, 1981). These are mainly erosional landforms, given that high slope gradients have prevented the conservation of extensive moraine deposits.

However, very little remains of the Apuan glacial landforms. With time, evidence of their presence has been eliminated by fluvial-glacial or fluvial processes, by the karst processes particularly influential in the Apuan area, given the lithology and rainfall regime, but also by the action of man with the centuries-old marble quarrying activities. The latter have destroyed the glacially-modelled slopes, removing both erratics and moraines. It is for this reason that the few remaining forms should be carefully safeguarded. From an initial survey on Apuan glaciation, two sites in particular have been identified which deserve, for different reasons, special attention and require a clear policy of sustainable conservation.

The first site is that of the Arni moraine, which, despite its importance in the history of glacial studies in the Apennines, is today in a serious state of degradation. The second is the glacial complex of Campocatino, which, on the other hand, is well conserved, easy to interpret and particularly suitable for educational activities associated with glacial processes.

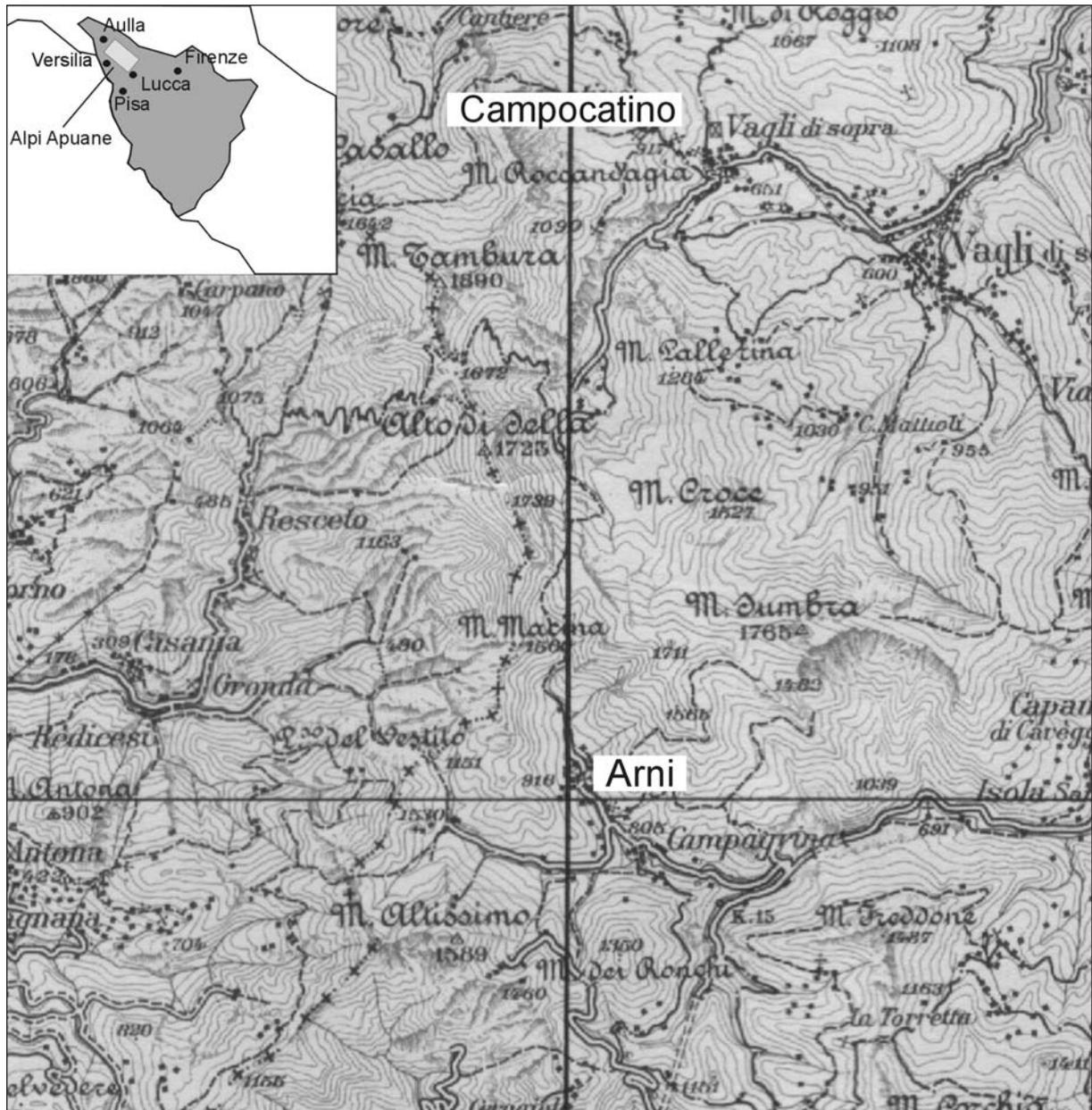


Fig. 1 - The Study area at the scale of 1:65.000 (Enlarged from Foglio 96 –Massa- of Carta Topografica d’Italia, IGM).
 L’area di studio scala 1:65.000 (Ingrandimento del Foglio 96 - Massa - della Carta Topografica d’Italia –IGM-).

2. THE ARNI MORAINES

The Arni moraine (Fig. 2) is a typical example of the degradation undergone by the Apuan glacial landforms. It appears in an impressive section near the village of Arni at an altitude of 920 m. The deposit reaches a height of 50 m starting from the bed of the Turrite Secca torrent and is made up of a chaotic mass of marble pebbles with subordinate presence of also phyllites and verrucan schists. In the complex there is a well-cemented medium-to-finely grained matrix, and in some pebbles the typical glacial striations can be seen.

The moraine was the first glacial deposit of the Apennines to be described in 1872 simultaneously by Cocchi and Stoppani. The two geologists identified the

moraine separately and such was the reciprocal respect between the two that neither of them claimed for himself this important discovery. In particular, Stoppani described it as a: “...*morena composta quasi esclusivamente da massi di bianco saccharoide, roccia che costituisce quasi per intero le montagne dell’ingiro della valle. Gli scisti talcosi, talora quarziferi, che si scoprono associati ai calcari ai limiti della morena e si levano verso monte Altissimo si scoprono in frantumi nel detrito morenico. Alla presenza di queste rocce si deve certamente la striatura dei massi calcarei che si presentò nel modo più evidente alla estremità occidentale precisamente ove dipende dal M. Altissimo*”. In order to understand how important the discovery of the Arni moraine was in the history of glaciation in the

Apennines, it is enough to read the few lines that follow: *“L’esistenza d’un ghiacciajo nella Val d’Arni può ritenersi come indizio sicuro dello sviluppo del terreno glaciale nelle Apuane, principalmente sui versanti settentrionali e nei bacini dipendenti da montagne più alte di quelle della Val d’Arni. Non manca pure di acquistare valore di somma probabilità d’opinione da me già espressa nel 1865 che antichi ghiacciai debbano scoprirsi nelle regioni più elevate dell’Appennino centrale, principalmente nelle dipendenze del Gran Sasso d’Italia, il quale avendo 2899 m di elevazione, supera del doppio quella del M. Altissimo, che è di soli 1590.”* (The presence of the Arni moraine was considered by Stoppani to be important evidence suggesting the existence of glaciers elsewhere in the Apennine chain). Cocchi, from the Lunigiana area, who describes the moraine as being a little less extensive than Stoppani, remarks how the deposit *“...lungi dall’essere isolato è anzi frequente ripetendosi in tutte le vallate principali delle nostre Pania”*, in this way reinforcing the opinion of Stoppani regarding the probable widespread distribution of this type of deposit in the Apennines.

The Arni moraine is at a higher altitude compared to the other Apuan moraines, probably because the glacier which generated it was the only one facing south. Other small ice masses extended down from Monte Fiocca towards south, west and south east, whilst a larger mass, which was the largest part of the Arni glacier, extended southwards from Passo Sella and from Monte Macina. Along the channel of Burrone at 1050 m we can see some scarce morainic detritus, but the area, as is often the case in this district, has been so disturbed by the marble quarrying that almost all the remaining deposits have been obliterated. The Arni moraine remains the only deposit that is still visible and offers a particularly detailed section which can be

used to illustrate the salient features of glacial and fluvio-glacial deposits and their interrelationships. The site of the section is easily accessible by car and there are very suitable facilities nearby, such as hotels, restaurants and bars. Its exploitive characteristics, together with its high scientific and historical value, make it an ideal geosite. Today however the moraine is in a state of serious degradation. To make things worse, close by there is an illegal dumping site and a water purification plant has recently been built in the area. Despite the protection afforded by the Park of the Apuan Alps there is no corresponding sustainable exploitation of the site. In fact, there is basically no recognition of the inherent value of the site, either in the local community or among the few tourists who visit the area. Unfortunately, it is effectively an area better known for having been ruined by the quarrying activity. Recovering and sustainably developing this site would mean a significant contribution to re-evaluation of the area.

3. THE GLACIAL COMPLEX OF CAMPOCATINO

The glacial complex of Campocatino (Fig. 3) is of great educational interest and is an area recognised as important by the local community, and which is the destination of a certain number of tourists, also because of its location near the well-known medieval village of Vagli. Campocatino is a veritable jewel in the Park of the Apuan Alps. It is a small glacier, 1 Km long, which originated from the Monti Tombaccia and Roccandagia, and extended down to a small glacial hollow with a length of 500 m and width of 250 m, creating a double circular moraine with the typical arched shape in its frontal part (Paci, 1935; Tongiorgi & Trevisan, 1940).

The two moraines, about ten metres high and 500 m long, are almost exclusively made up of marble from M. Roccandagia. The matrix is scarce, particularly in the external circle, due to the limited transport of these materials. The shape is typical and the deposits, despite their small size, are easy to interpret and very well conserved. Using the moraine it is possible to reconstruct, something quite rare in the Apuan Alps, various glacial stages or frontal oscillations of the glacier. The landscape is made even more impressive by the presence of a small pastoral village, with small stone-built alpine huts standing on the moraines and once used by the shepherds coming from the lower valley of Vagli di Sopra and neighbouring areas during transhumance. This human element, which reflects one of the typical activities of the Apuan area, particularly in the Garfagnana valley, adds a cultu-



Fig. 2 - Frontal view of the Arni morainic deposit. Notice the general degrade of the area with poor potential preservation.

Vista frontale del deposito morenico di Arni, da notare il generale degrado dell’area.

ral historical value to the natural resource. Another anthropic element of a certain historical importance is the hermitage of St. Viviano, which can be reached in only 30 minutes on foot. Apart from its particular geological, geomorphological and historical-cultural features, the area is also of great interest as regards fauna and flora. In fact, there are rare and endemic species, so much so that the area has been a LIPU (Italian League for the Protection of Birds) reserve since 1991.

Although size is usually an important criterium in recognising the quality of a geomorphosite, in this case it is precisely the fact of being a miniature glacier which makes it possible to find a combination of erosional landforms, like the cirque in the higher part of Monte Roccandagia, and depositional forms which are easy to interpret and difficult to find elsewhere in a limited area. It is these factors that determine its high educational value. In the Plan of the Regional Park of the Apuan Alps, the area of Campocatino is rightly designated as a unique landscape which combines botanical and geomorphological features with a high historical-cultural value of a still very well conserved rural settlement. The presence of suitable tourist infrastructures makes this site particularly suitable for sustainable exploitation. However, locally there is still essentially a lack of an interpretative process and realisation of the area's intrinsic value.

4. CONCLUSIONS

From an initial analysis of the Apuan glacial landforms we can identify two sites worth safeguarding and exploiting. One is the Arni moraine, which is currently in a state of degradation and lacking in any form of interpretative initiative or sustainable development of the local landscape.

The other site is the glacial complex of Campocatino, which, due to its clearly interpretable forms, its state of conservation and its added ecological and historical-cultural value, is an ideal geosite. The easily accessible positions of the two sites make them particularly suitable in terms of educational and informative initiatives, without having to modify the existing physical infrastructure, therefore with a need for limited investments. It is without doubt that a suitable exploitation of these two resources would have positive knock-on effects on the economy of not only the Park, but also of the local communities. It could contribute to



Fig. 3 - Overview of the glacial complex of Campocatino with the frontal moraine (dashed line) and the backward humid depression.

Vista panoramica del complesso glaciale di Campocatino, con la morena frontale (linea tratteggiata) e la retrostante zona umida.

promoting sustainable tourism and a new environmental recognition which, in turn, could generate new forms of protection and respect and consequently long-term conservation of these resources.

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