

Rita T. Melis, Felice Di Gregorio, and Valeria Panizza

## Abstract

Sardinia is characterized by spectacular granite landscapes with superimposed scenic landforms. In the eastern part of the island, the granite reliefs consist of mountain massifs and plateaux separated by metamorphic reliefs and limestone plateaux. Granite landscapes show peculiar landforms such as inselbergs, tors and tafoni and diverse erosion microforms. In the extraordinary landscape of Gallura region, wide flat areas with outcropping rocks, vast extensions of isolated rock blocks and inselberg-type dome-shaped reliefs show evidence of a long period of intense weathering. Scenic landforms characterize the spectacular landscape of Sarrabus region, where differential erosion processes have selected the numerous dikes which have conditioned the orientation of the reliefs and coastal landforms. Many archaeological remnants can be found in most granite regions of Sardinia emphasizing the deep bond between man and the physical environment.

## Keywords

Granite • Weathering • Inselberg • Tor • Tafoni • Sardinia

## 30.1 Introduction

Sardinia is the second largest island in the Mediterranean Sea. Its landscapes are of great geo-diversity and the most spectacular ones are supported by granite bedrock, formed during the uplift of the ancient Variscan chain. Scenic landforms occur in an amazing variety of shapes and settings and are superimposed on splendid granite landscapes.

Throughout the island, the Sardinian granite landscape is characterized by rugged mountains cut by deep gorges, vast

uplands scattered with block piles, and large hills covered by Mediterranean scrub. Indented coasts, shaped into promontories, bays and small islands border the ancient granite masses that rise from the sea. Strange landforms carved in granite have inspired the people's imagination.

These spectacular granite landscapes are located almost continuously in the eastern part of the island, from Capo Testa to Capo Carbonara (Fig. 30.1). In this part of Sardinia, granite terrains do not form a high and continuous ridge but a series of mountain massifs and plateaux separated by areas underlain by metamorphic rocks and limestone plateaux. The Limbara massif to the north dominates the Gallura landscape, while to the south the Sette Fratelli (*Seven Brothers*) massif characterizes the Sarrabus landscape.

Similar landforms are present in all granite landscapes of Sardinia, but local structural and lithological conditions allow different morphological features to be distinguished and, as Migoñ (2004, p. 30) wrote: “*there are granite landscapes and granite landscapes*”.

R.T. Melis (✉) · F. Di Gregorio  
Dipartimento di Scienze Chimiche e Geologiche, Università di  
Cagliari, Via Trentino 51, 09127 Cagliari, Italy  
e-mail: rtmelis@unica.it

V. Panizza  
Dipartimento di Storia, Scienze dell'Uomo e della Formazione,  
Università di Sassari, Via Zanfarino 62, 07100 Sassari, Italy

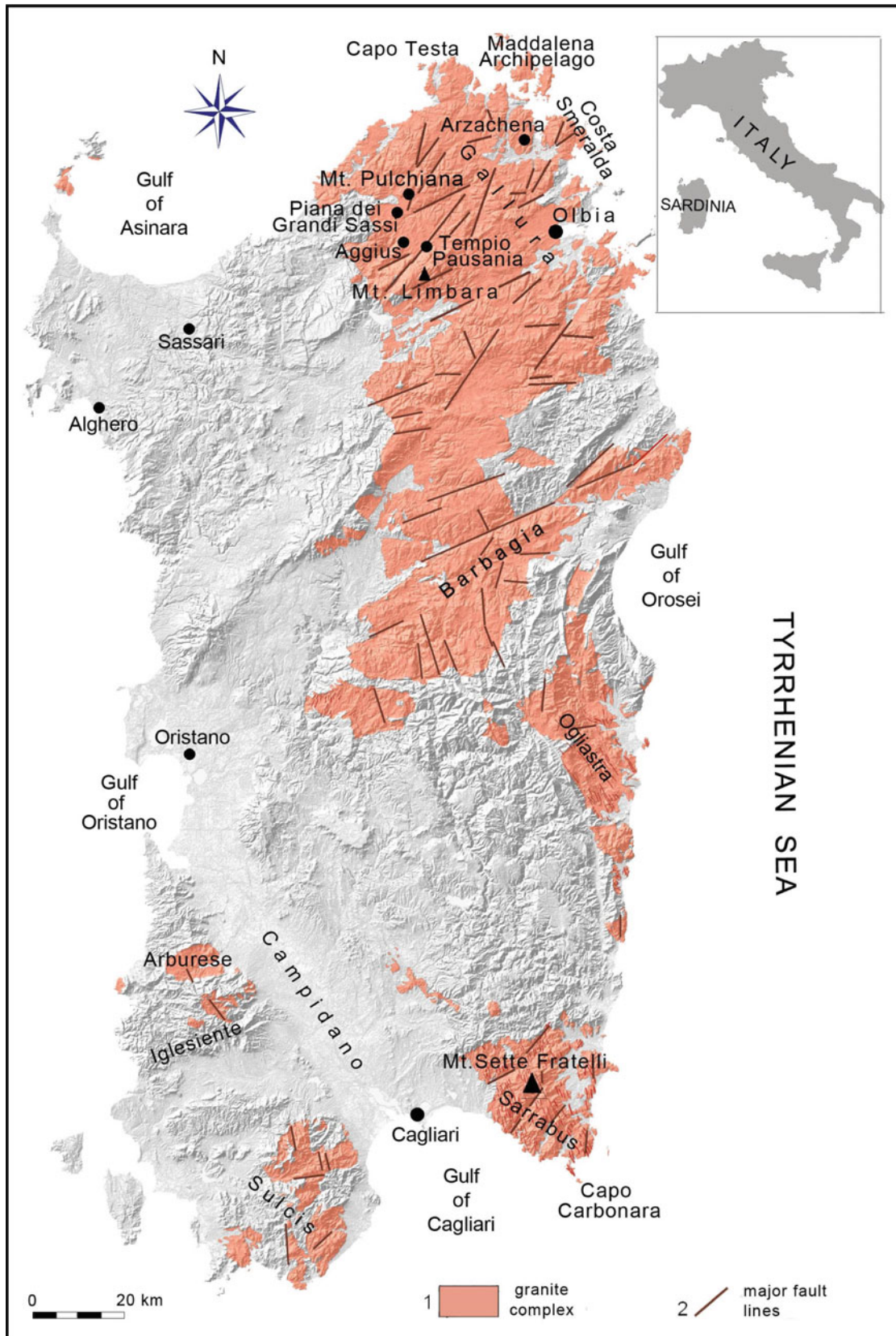


Fig. 30.1 Schematic map of the granite outcrops of Sardinia

## 30.2 Geographical and Geological Setting

The island of Sardinia is located between 38° 51' 52" and 41° 15' 42" latitude north. It covers a total area of 23,821 km<sup>2</sup> of which some 6000 km<sup>2</sup> are built by widespread calc-alkalic granitoids intruded in the polydeformed and metamorphosed Palaeozoic basement during Variscan Orogeny, from 350 to 290 Ma BP (Rossi et al. 2009). During this long period of time, changes occurred in the geodynamic framework, influencing the structural and compositional characteristics of various intrusions.

The Sardinian batholith consists of numerous intrusive bodies of variable size and plutons from granodiorites to leucogranites with incidental amounts of tonalite and gabbro (Orsini 1976). Permian hypo-volcanism produced numerous basic and acid dikes crossing the batholith in various directions. At the end of the Carboniferous, the uplifting of the Variscan chain fragmented the granite basement and led to partial erosion of the granite plutons.

The Oligo-Miocene anticlockwise rotation movement of the Corso-Sardinian block and the Alpine collision produced major faulting and tilting in the granite batholith. Its outcrops are mainly found in the Gallura and Barbagia region in the north and in the Sarrabus region in the south (Fig. 30.1). Minor outcrops of granitic rocks are present in the Sulcis-Iglesiente and Arburese districts, in the western portion of the island. In these granite regions, the average altitude is about 300 m a.s.l., with the top peaks of Mt. Limbara (1362 m) to the north and Mt. Sette Fratelli to the south (1023 m).

Typically, the climate is Mediterranean with mean annual precipitation of some 650 mm and mean annual temperature of about 23 °C. In summer maximum values exceeding 40 °C can be attained and in the winter minimum values below 0 °C are recorded at high altitudes. Precipitation often occurs in the form of storms, with very intense but short duration rainfall events in autumn and winter. Winds are frequent and very strong throughout the year, particularly the cold Mistral from the northwest and the hot humid Scirocco from the south. The most important geomorphological control is exerted by the geological-structural setting, but also by the climate, in particular past climate changes. Typical granite landscapes of Sardinia displaying significant landform diversity can be found in the Gallura and Sarrabus areas and these will be described below.

## 30.3 The Gallura Landscape

The northeastern portion of Sardinia is known as Gallura, a region famous for its rose-coloured beaches and crystal-clear sea, where the famous "Costa Smeralda" and Maddalena Archipelago are found. This area is also known for its

extraordinary archaeological heritage, the production of renowned wines, such as Vermentino, and the presence of widespread cork oak (*Quercus suber*) woods.

The landscape is dominated by granitoid rocks, since the Variscan granite batholith crops out extensively with many mineralogical-petrographic variations. Since the mid-nineteenth century, the Gallura landscape has stimulated studies by historians, geographers and geologists who made observations and formulated scientific theories still valid to date and which preceded the more recent geomorphological investigations.

Thanks to the exceptional landforms, numerous protected areas of natural or international importance have been established or are being established. Among these, the Piana dei Grandi Sassi and Mt. Pulchiana are a Natural Reserve and Natural Monument, respectively. They are both located in the municipality of Aggius, in northwestern Gallura. The average altitude, orientation and shape of major landforms generally follow regional tectonic features, with prevalent NE–SW and NNE–SSW alignments, as in the case of the Piana with its saw-toothed crests, locally known as "serre", towards southeast near the village of Aggius, or the alignments of the relief where the Mt. Pulchiana dome is found. These are the dominant tectonic orientations, especially in the Gallura landscape, which make up, as already observed by Pelletier in 1960 (p. 12), "*the morphological personality of the whole region*". The imposing granite rock masses, cropping out everywhere with their typical petrographic and mineralogical variations and tectonic alignments, give the landscape its characteristic features, modelled on a small to medium scale by physical and chemical processes.

Out of the Carboniferous-Permian calc-alkaline association characterizing most of Sardinia's granite, inequigranular monzogranites and equigranular leucogranites prevalently crop out in this area (Carmignani et al. 2001). The former are found in the whole Piana dei Grandi Sassi whereas the latter are widespread in the Mt. Pulchiana and in all the surrounding ridges. Apart from their mineral associations, these granites can be distinguished by the average size of the phenocrysts and the shades of colour, which is typically pinkish in the leucogranites. The whole area is located within a wide belt bounded by two important NE–SW oriented left transcurrent faults, ascribable to Miocene compressive tectonics. Tectonic processes disrupted and displaced the crystalline basement with the formation of the major large-scale physiographic structures and corresponding elevations of the batholith: high-standing structures, wide depressions, horizontal or gently inclined plateaux. Along the dense joint network, intense modelling of relief forms took place in geological times and under diverse climate conditions. Also the hydrographic network follows the main structural alignments almost perfectly.

The granite outcrops with their round-shaped or saw-toothed relief, typical of this region, show sets of regular joints normal to each other. Spectacular forms can be observed where differential erosion has outlined the Permian dikes, such as the porphyritic-microgranite dike disrupted by a fault which characterizes the coastal landscape of Capo Testa.

There has always been a close link between the granite landscape and humans, which has remained strong across the centuries linking many historical, religious, social, etc., vicissitudes. In this part of Sardinia, the availability of resistant building materials, often already available in blocks isolated by the jointed network, was of great importance to the local population. Also the spectacularity and impressiveness of the relief have become part of daily life, socio-economic needs and human imagination, thus producing a constant intrigue between culture and natural landscape. The first evidence of human presence in Gallura dates back to the early Neolithic, in the form of remains of temporary settlements inside wide tafoni. Indeed, these natural cavities have always been a geographic factor accompanying man throughout history, serving as shelters, burial sites or stabling for animals.

Also in recent and even present times, the traditional kind of scattered-habitat settlement, typical of the region, makes use of the many natural morphological features offered by granite to give shelter to farm animals, store tools and create temporary shelters. Some of these landforms show rather curious shapes which in popular imagination have conjured

up animal and anthropomorphic figures or even other elements taken from the natural world, such as the Arzachena Toadstool, inside which remains of artefacts were found testifying its use as a shelter in a period ranging from 3500 BC up to the Nuragic age. Also along the Gallura coasts subaerial weathering has created extraordinary forms, among which the famous Palau Bear, which has been declared a regional natural monument (Fig. 30.2).

In this region, archaeological sites such as rock ledge shelters, funerary or cult circles, funerary tafoni and dolmens are extremely important testimonies. Among these, the so-called “Tombs of the Giants” are made up of huge vertical granite slabs (Fig. 30.3). There are many other monuments which witness not only the widespread use of granite rocks in very remote times but also a spiritual relationship with the landscape which in time has created a kind of social organization and adaptation to the environment forming the local identity. The whole of Gallura preserves innumerable sites which can be included in the category of geomorphosites owing to their scientific and often cultural interest (cf. Panizza 2001). Some of these, such as the Palau Bear or Mt. Pulchiana, are protected by specific norms whereas in other cases the introduction of adequate conservation measures and sustainable tourist fruition would be desirable. Indeed, the intrinsic value of the landscape of this region lies in the geohistorical heritage (*sensu* Panizza and Piacente 2009) of its geological-structures and relief forms as well as in the richness of its archaeological and cultural heritage and in the constant functional and cultural links between its

**Fig. 30.2** The Palau bear: a spectacular form resulting from subaerial weathering which dominates the coastal landscape of Gallura and the Maddalena Archipelago



**Fig. 30.3** Coddu Vecchiu giant tomb: sepulchral Nuragic monument in granite blocks worked by man (Bronze Age, 1800 years BC to 1300 years BC) and, in the *background*, a vineyard of Vermentino di Gallura wine



components. Therefore, it is a cultural landscape where the relief and the geological-structural characteristics are in constant interrelation with the human element (Panizza and Piacente 2009) and convey shareable values and messages.

### 30.3.1 Piana dei Grandi Sassi

The Piana dei Grandi Sassi is a wide flat area scattered with rock blocks and tors (i.e. free-standing residuals approximately of the size of a small house), surrounded by generally round-shaped reliefs and cut across by the Riu Turrari stream from SW to NE. This spectacular plain is located in the inner part of the wider plateau of Tempio Pausania bordered in the south by the granitic massif of Mt. Limbara. This inner plain has average elevations between 425 and 460 m, whereas the surrounding ridges reach a maximum altitude of 680 m. The lower slopes are connected to the plain at a sharp angle, although in some places the contact surface is gentler owing to the accumulation of residual materials and blocks of various sizes.

This wide area is lower than the surrounding terrains which are arranged according to the prevailing tectonic alignments. Its scenery is spectacular, with wind-bent cork oak trees and grassy tablelands dominated by Mediterranean scrub where flocks of sheep often graze. Everywhere there are chaotically arranged rounded boulders and compact granite outcrops a few metres high (Fig. 30.4). Deposits of residual material partially reworked by pedogenesis fill the plain and the depressions whereas piles of jointed rock

blocks stand out in the landscape. A large amount of prevalently round-shaped boulders has been formed by the progressive weathering of the granite blocks and tors.

The boulders are of varying sizes and are scattered practically everywhere across the plain, giving the landscape a very unusual appearance which has made this area particularly well known with the name of “Piana dei Grandi Sassi” (Plain of the Big Blocks). The geological-structural setting and, in particular, the climate changes occurring in the Cainozoic and in the past 2 million years favoured the genesis of numerous landforms now scattered across this particular plain. The erosion of the weathered materials—which originated in past hot and humid periods—carried out by running waters has made the tors and scattered boulders to emerge from the weathering mantle. Exfoliation and disintegration processes occurring during the most arid phases have certainly had an important role in the modelling of these scenic forms.

Everywhere in the plain, the rocky outcrops and blocks have been hollowed out, with cavities varying considerably in width and depth from a few tens of centimetres up to a few metres. They are tafoni (locally known also as “conchi”) which result from granular disintegration of microfissured rock surfaces. This surface weathering is controlled by water penetration into the rock and minerals and is more marked on shaded rock faces where mistiness maintains a high humidity level. The initial phase of the hollowing process can take place under the surface (cf. Twidale 1982), thanks also to subsurface micro-percolation conditions of groundwater inside the granite joint network or underneath the weathering



**Fig. 30.4** Panoramic view over Piana dei Grandi Sassi, with wide extensions of large isolated boulders and rock heaps (tors); in the *background* the Serre di Aggius

mantle (cf. Roqué et al. 2013). A more advanced stage of development of tafoni is observed at the base of the blocks.

In these areas, which are more protected from direct sun rays, rock disintegration process has been more intense from

the bottom towards the top, thus creating large cavities. Some of these have been used as shelters or burial sites in Prehistory and, up to the 1970s, as sheep shelters during transhumance. In other cases, shepherds have

**Fig. 30.5** The Mt. Pulchiana inselberg with its typical dome-shaped profile and the fantastic tors, chaos of blocks and tafoni scattered at the base of steep slopes. In the *foreground* one of the tafoni utilized as a shepherd shelter



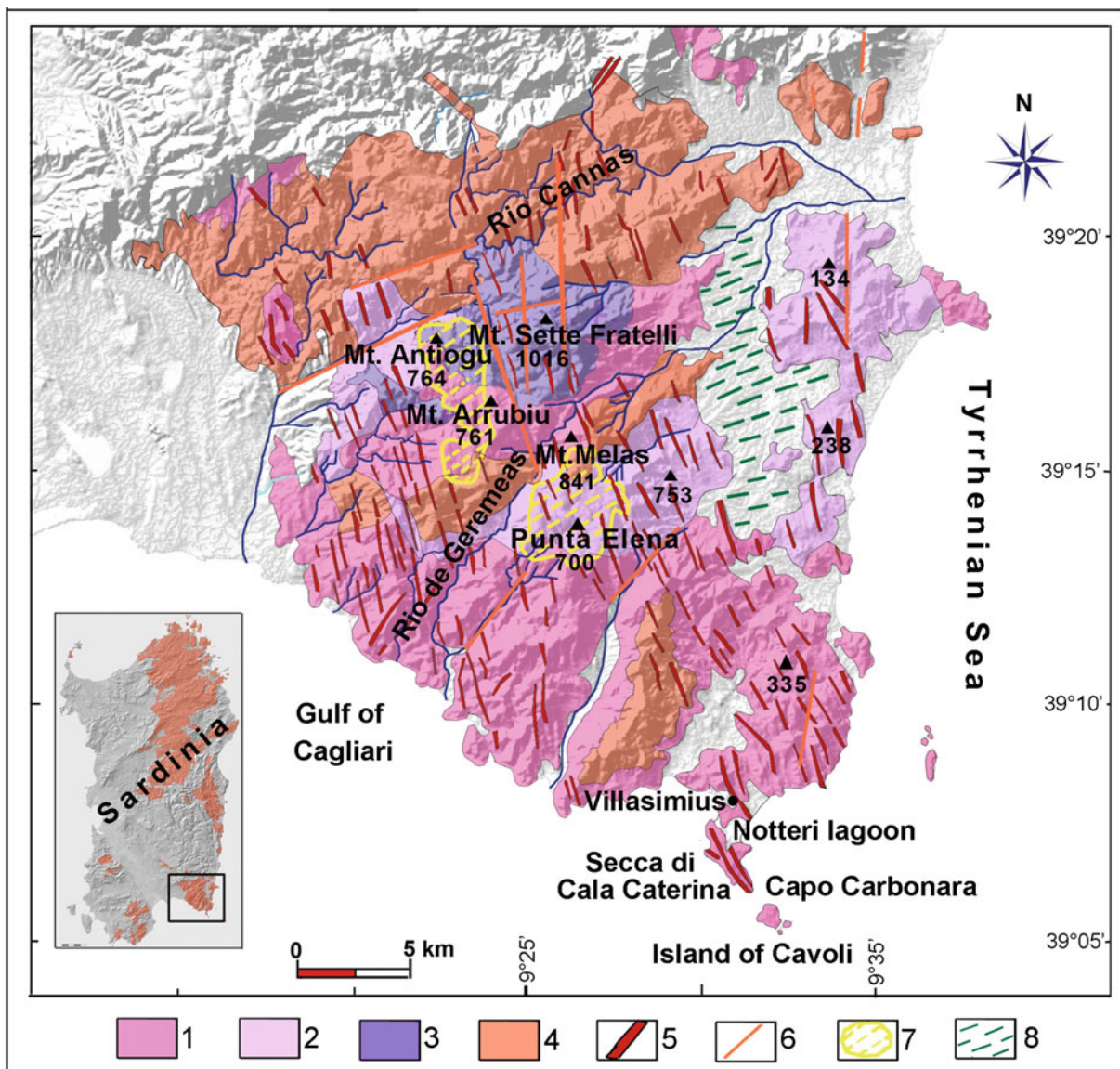
transformed the largest tafoni into rustic houses or shelters for their animals by adding walls of small granite blocks (Fig. 30.5).

Most of the tafoni are no longer active. Active disintegration processes can only be observed in particular conditions of dampness and exposure, and are visible on the wettest walls, with the formation of easily detachable weathered material which accumulates on the ground.

### 30.3.2 Mount Pulchiana

Mt. Pulchiana (673 m), rising just northeast of the Piana dei Grandi Sassi, is an extraordinary landform characterized by a

dome-shaped top and may be defined as an inselberg. It rises from the surrounding plain surmounting a ruin-like chaotic landscape rich in tors, rock boulders and tafoni of all sizes (Fig. 30.4). Here the landscape has been controlled by the transcurent tectonics of this region which has defined crests and reliefs and has conditioned the contrast with the nearby plain. The evolution of this spectacular dome-shaped landform was controlled by the regional fault system and the complex set of joints. Mt. Pulchiana is located inside a vast granite area bounded by NNE–SSW and NE–SW trending faults. Furthermore, the orthogonal joint system characterizing the rock mass has isolated smaller rock portions, one of which hosts this outstanding inselberg. The orientation and spacing of joints have controlled the weathering processes



**Fig. 30.6** Geological and geomorphological sketch of the Sarrabus granite landscape. 1 Granodiorites, 2 monzogranites, 3 fayalite biotite granites (Mt. Sette Fratelli), 4 leucogranites, 5 dikes, 6 faults, 7 plateau, 8 pediment

and, subsequently, the removal of weathering products carried out by running waters.

In detail, the northwestern slope of Mt. Pulchiana is steeper than the eastern one because of a fault which has favoured the fall of large fractured blocks. Thick Mediterranean scrub covers the abundant boulders and debris accumulated at the foot of the slope. On the other hand, the northeastern slope of this inselberg, which is characterized by sheer convex faces of outcropping rock, is affected in its higher part by mega-exfoliation phenomena due to the opening of sheeting joints. Along the steep southern face numerous joints can be observed in the outcropping rock, which cut across the leucogranites orthogonally. The mountain is separated from other minor ridges to the south by a paleo-valley set along a NW–SE trending fault, with the presence of huge, scattered blocks. The chaotic distribution of rock fragments and rounded blocks, scattered or piled up in heaps, characterizes the footslopes all around the inselberg. This view is very striking, owing also to the presence of many tafoni of various sizes and shapes. Near the top of Mt. Pulchiana the slopes are steeper and ascent can continue only by overcoming narrow and steep passages between rock blocks, within natural cavities and dense thickets of Mediterranean vegetation.

### 30.4 The Sarrabus Landscape

The Sarrabus granite massif, located at the southeastern extremity of Sardinia (Fig. 30.6), is bounded to the west by the Campidano tectonic trench and to the south and east by

the sea. It offers scenic landscapes scattered with spectacular forms. In Sarrabus, as well as in Gallura, the same spectacular granite landforms are found: plateaux, crests, tors and tafoni. In this region, however, the granite bedrock has been, on the whole, more affected by incision. Therefore, deep, narrow gorges are common and the relief energy is higher. This gives the Sarrabus landscape a more rugged, mountain-like and less accessible appearance compared with the Gallura landscape. The Sarrabus massif is shaped into different calc-alkaline bodies which were intruded into the metamorphic basement during Variscan Orogeny and subsequently, in the Cainozoic, were tilted during the east rotation of Sardinia. Numerous acid and basic NW–SE trending dikes intersect the granitoid bodies. To the north, a deep valley separates this massif from the metamorphic terrain of Gerrei. To the south it descends gradually towards the Gulf of Cagliari and the Tyrrhenian Sea. Two different landscapes distinguish this scenic massif. To the west the landscape is characterized by high, rugged relief dissected by deep valleys, whereas to the east the landscape, which was tectonically lowered, becomes gentler, with lower elevations (300 m) and elevations separated by shallower valleys. The contrast between these two landscapes can also be noted by the different trend of the coast, which is high and rocky to the southwest, whereas it is much more irregular with numerous islands, wide bays and rocky promontories to the south and southeast.

In particular, the western landscape is more open than the eastern one and displays spectacular sceneries both in meso- and microscale. Tooth-sawed crests, steep rock faces, wild gorges dug into steep slopes, fluvial valleys enclosed in the

**Fig. 30.7** The peaks of Mt. Sette Fratelli with, in the *foreground*, a tor emerging from the remains of the plateau







**Fig. 30.8** **a** Bronze Age megalithic structure (Nuraghe) harmoniously blending with the tor blocks; **b** the joint systems in the granite along the Rio Cannas canyon; **c** numerous potholes on the valley floor dug in the granite rock

rock, pinnacles, towers and heaps of rock blocks give the area captivating appearance. In this impressive and striking landscape the Sette Fratelli ridge stands out; it is crowned by rocky crests and bounded by deep winding valleys which are often set along faults.

This area, which is one of the Sardinian Regional Natural Parks, is covered by thick Mediterranean scrub and by a

dense forest of holm and cork oaks (*Quercus ilex* and *Quercus suber*). Inside this imposing forest populated by the Sardinian Red Deer (*Cervus elaphus corsicanus*), seven rocky peaks stand out, like still giants watching over this mysterious landscape, giving origin to the place name of “Sette Fratelli” (Fig. 30.7). These mountain tops attain different elevations: from 791 m of “Perd’a Asub’e Pari” to

1016 m of “Punta Sa Ceraxa”, which to the north joins with the peaks of “Casteddu de Su Dinau” (915 m) and “Baccu Malu” (1015 m).

Since very ancient times, their dome-shaped forms and tors have been the subject of myths and legends lost in the mists of time. They stand like towers covered by rocks and appear to be built of a number of loose boulders. These scenic landforms are carved into well-jointed light greyish leucogranite with commonly occurring Fe-amphibole and Fe-biotite minerals, as well as fluorite in accessory amounts and subordinate fayalite (Secchi and Lorrai 2001).

This resistant granite is divided by normal sets of fractures. The evolution of the seven peaks has been influenced by the fracture spacing in each set. Intense runoff erosion has removed weathered material from fractures dissecting the peaks into large rock towers or tors and crumbling boulders. Isolated boulders crown these summits forming picturesque pedestals or rocking stones often of imposing dimensions, such as Punta Sa Ceraxa peak. This peak, whose name means *Point of the Cherry*, is made up of huge isolated blocks which apparently seem to be in precarious equilibrium, piled as they are one on top of the other. Nevertheless, boulder piles at the foot of the crests bear witness to mass wasting in the form of rock block falls.

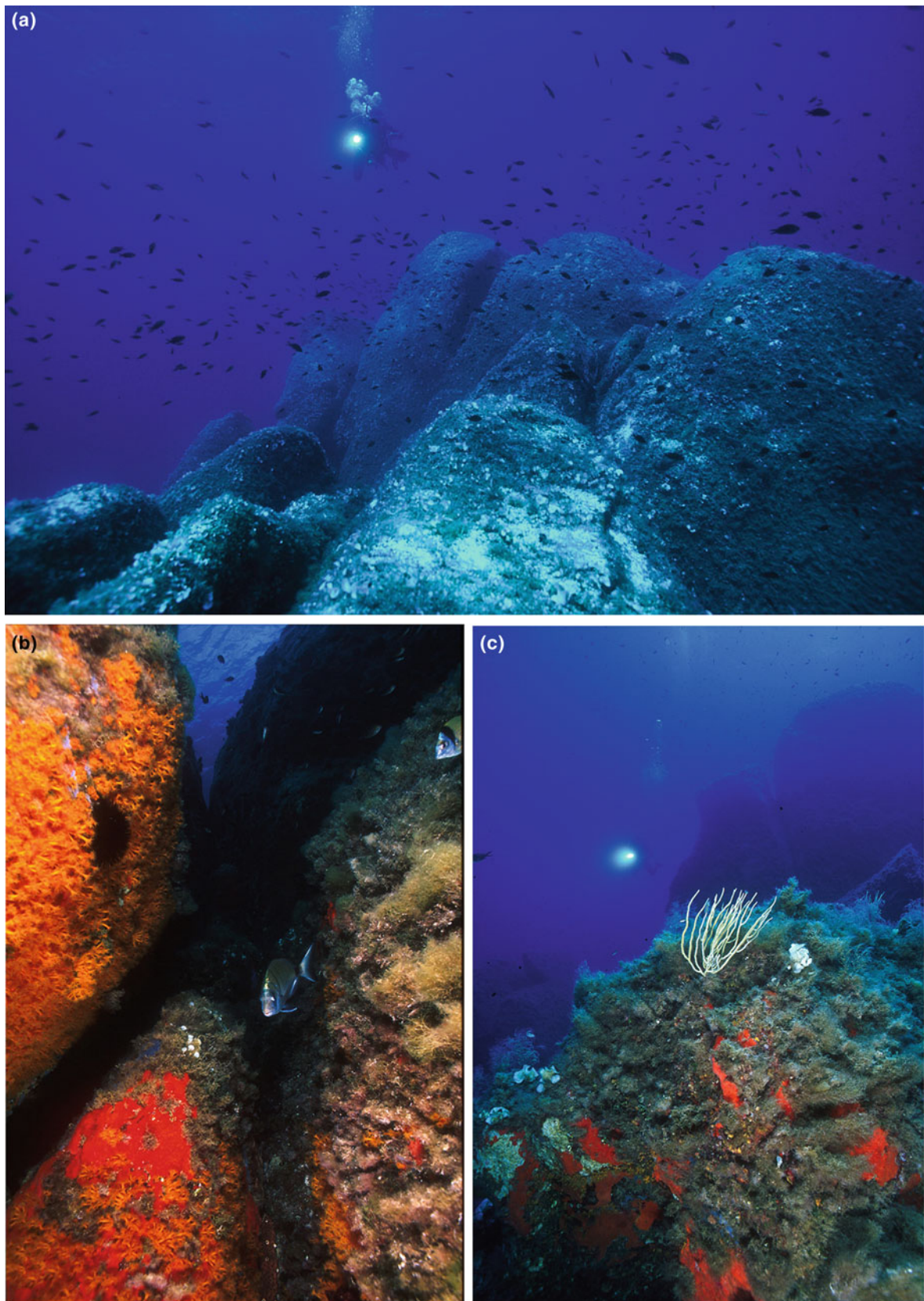
These scenic landforms are also the result of differential denudation, accomplished mainly by deep weathering during a long period of humid tropical climate. Fairly flat summit surfaces bound the Sette Fratelli relief to the west and south. They bear witness to the remains of a vast denudation area

which developed under warm and humid climate conditions at the end of Variscan Orogeny and was later shaped during Oligo-Miocene times. In this period, uplift of the granite rock masses led to an increase of erosion and considerable deepening of the valleys. The deep Rio Geremeas valley separates the two largest flat areas formed in the granodiorites. To NNW there is a very regular 700–800 m high plateau, on which the round-shaped hills of Mt. Antiogu (764 m) and Mt. Arrubiu (761 m) stand out as they were modelled in harder leucogranites. On the opposite side of the Rio Geremeas valley, the plateau is characterized by a surface slightly inclined to the south, from Mt. Melas (841 m) to Punta Elena (700 m). On these two plateaux, elongated depressions bear witness to ancient drainage preceding the Cainozoic uplift, which, in turn, led to the deepening of the valleys. Scattered blocks hollowed with tafoni protrude from dense Mediterranean scrub and characterize the plateau landscape. This gentle morphology, the presence of deep soils, wet areas and piles of rock blocks, could have provided the prehistoric peoples of the Nuragic civilization with favourable conditions for their settlements. Indeed, nestled among the tor blocks, the remains of Nuraghi—megalithic edifices dating from the Bronze Age (Depalmas and Melis 2011)—are hardly visible (Fig. 30.8a).

The deep, narrow valley of Rio Cannas surrounds the Sette Fratelli relief to the north. Striking scenery can be observed by proceeding along the winding canyon meandering in the rose-coloured leucogranites, monzogranites and granodiorites. In the bare walls of the Rio Cannas canyon

**Fig. 30.9** Panoramic view of coast of the Capo Carbonara promontory: piles of rock blocks on the beach and, in the background, the Sarrabus granite reliefs





**Fig. 30.10** Images of sea floor along the Villasimius coast: **a** granite block piles on the sea floor on the Capo Carbonara coast; **b** habitat for large groupers (*Serranidae*) and gilt-head breams (*Sparus aurata*) between granite blocks on the shoal of “Santa Caterina”; **c** a granite

block coloured by the Yellow Cluster Anemones (*Parazoanthus axinellae*) and by the red Gorgonaceae on the Capo Carbonara sea floor (courtesy Area Marina Protetta Capo Carbonara—Comune di Villasimius)

various joint systems can be identified, which separate the outcropping granite units into irregular prismatic blocks (Fig. 30.8b). Fields of porphyry, but also quartz, pegmatite and lamprophyre dikes dissect the granite and arrange the surrounding ridges in the form of crests and inaccessible precipices. In the valley floor fluvial erosion has cut across some rock bars and dug numerous potholes in the riverbed (Fig. 30.8c).

To the south, the Sarrabus granite massif slopes down towards the coast, whereas to the east it is affected by a series of fault scarps. This area is mainly characterized by flat surfaces which almost completely isolate the low ridges to which they are abruptly connected. These flattish areas, identified by Pelletier (1960) as pediments, bear witness to long-term landscape evolution and its advanced stage. On the surface of the pediments the monzogranite and granodiorite bedrock is covered by weathering deposits affected by pedogenesis. It crops out in some parts or is covered by a thin layer of debris and sand. Small residual inselbergs, partly covered by prairie or thick Mediterranean scrub, emerge from the plain.

To the south, in the territory of Villasimius, differential erosion processes have isolated numerous acidic dikes that dissect the granodiorites outcrops. In fact, the crests and parallel valleys are all oriented according to the NW–SE arrangement of the dikes. This marked orientation is found also in the relief of the triangular promontory of Capo Carbonara, linked to the coast by sand bars in which the splendid Notteri lagoon nestles. Various porphyritic-microgranite dikes give the tip of the promontory a particular shape, modelled also by marine erosion (Fig. 30.9). In this sector, the narrow top of the rocky relief suddenly slopes down towards its extremity by means of a fault scarp. The sheer slopes are made up of granite bedrock and scattered blocks. There are also unusual tafoni in the landscape dotted by bushes of Mediterranean scrub. Along the coast, wave-modelled rocks can be seen whereas beneath the crystal-clear waters of the sea fascinating sceneries are revealed by the granite rocks forming pinnacles (Fig. 30.10a), buttresses and depressions, often coloured by the yellow of zoanthid coral or Yellow Cluster Anemones (*Parazoanthus axinellae*) or by the red of the *Gorgonaceae* (Fig. 30.10c). On the sea floor near Secca of Cala Caterina, south-west of the promontory, a fantastic submarine display of rock piles can be admired which makes up the ideal habitat of peaceful populations of large groupers (*Serranidae*) and gilt-head breams (*Sparus aurata*) (Fig. 30.10b).

Opposite the Capo Carbonara point, at a distance of some 700 m, the small island of Cavoli is found which represents the continuation of the promontory into the sea. The joints of the granite bedrock and the dike system have created the beautiful main inlets and alignment of two small elevations

(40 m) which give the place its morphological character. Deeply jointed rock blocks characterize the tops of the two ridges which are linked by means of a gentle saddle. Small heaps of blocks emerge from the bushes and adorn the morphology of the island whilst thin sand deposits resulting from weathered granite accumulate in the inner depressions and rock fractures, favouring the development of soil and vegetation.

Along the coast of this wind-swept island, granite surfaces usually remain fresh because of the constant washing effect of the waves. On the other hand, aerosol and high salinity favour weathering processes on the rock surfaces which are not exposed to the direct action of the sea and produce tafoni. These typical subaerial landforms are at present found also in submerged areas and bear witness to sea-level fluctuations in the past 20,000 years.

---

## 30.5 Conclusions

The spectacular granitic landscapes of Sardinia result from weathering and long-term denudation occurring under changing climates from the early Cainozoic to the present. The Gallura and Sarrabus landscapes, in particular, offer a range of major and small-scale granite landforms that reflect local structural and lithological conditions. Wide flat areas dominated by inselbergs and covered by rock blocks, shaped in tafoni, characterize the Sardinia northeastern landscape. The island's southeastern landscape offers high relief, surrounded by crests and dissected plateaux framed by scattered tors. The coastal landscape, affected by differential erosion of dikes, shows various scenic features such as spectacular archipelagos, splendid lagoons and promontories. Due to their strong naturalistic interest and their cultural values, these landforms represent an important geoheritage of the Italian landscape. Palau Bear and the Mt. Pulchiana landforms are protected by regional laws as natural monuments, while two protected areas are set up, respectively the National Park of the La Maddalena Archipelago and the Protected Marine Area of Capo Carbonara promontory.

---

## References

- Carmignani L, Oggiano G, Barca S, Conti P, Salvadori I, Eltrudis A, Funedda A, Pasci S (2001) Geologia della Sardegna. Note illustrative della Carta Geologica della Sardegna a scala 1:200.000. Mem Descr Carta Geol d'It 40:1–283
- Depalmas A, Melis RT (2011) The nuragic people: their settlements, economic activities and use of the land. In: Martini PI, Chesworth W (eds) Landscape and societies. Selected cases. Springer, The Netherlands, pp 167–185
- Migoñ P (2004) Structural control in the evolution of granite landscape. Geographica 1:19–32

- Orsini JB (1976) Les granitoides hercyniens corso-sardes: mise en évidence de deux associations magmatiques. *Bull Soc Geol Fr* 18:1203–1206
- Panizza M (2001) Geomorphosites: concepts, methods and examples of geomorphological survey. *Chin Sci Bull* 46:4–6
- Panizza M, Piacente S (2009) Cultural geomorphology and geodiversity. In: Reynard E, Coratza P, Regolini-Bissig G (eds) *Geomorphosites*. Pfeil, München, pp 35–48
- Pelletier J (1960) Le relief de la Sardaigne. Institut des Études Rhodaniennes de l'Université de Lyon, Mémoires et Documents 13:1–484
- Roqué C, Zarroca M, Linares R (2013) Subsurface initiation of tafoni in granite terrains. Geophysical evidence from NE Spain: geomorphological implications. *Geomorphology* 196:94–105
- Rossi P, Oggiano G, Cocherie A (2009) A restored section of the “southern Variscan realm” across the Corsica-Sardinia microcontinent. *CR Geoscience* 341:224–238
- Secchi F, Lorrain M (2001) Some geological and environmental aspects of the Sàrrabus-Gerrei region (SE Sardinia, Italy). *Rend Sem Fac Sc Univ Cagliari* 71:187–208
- Twidale CR (1982) *Granite landforms*. Elsevier, Amsterdam, 372 pp