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THE EUGANEAN HILLS: GUIDE OF THE FIELDTRIP

ABSTRACT: PELLEGRINI G.B. & SEDEA R., *The Euganean Hills: guide of the fieldtrip*. (IT ISSN 1724-4757, 2005).

The Euganean Hills are extinct subvolcanic edifices exposed by erosion, which removed most of their thick sedimentary cover and part of the underlying eruptive rocks. These Hills rise from the alluvial plain surrounding them as isolated relief south-east of Padova (North-East Italy). In the Euganean Hills outcrop Upper Jurassic to Lower Oligocene marine sediments. Volcanic rocks belong to two magmatic events of Upper Eocene (basalts) and of Lower Oligocene age (rhyolites, trachytes, latites) respectively.

In this fieldtrip are presented and discussed an up-to date illustration of the geology, of the geomorphology and of the well-known euganean hydrothermal system of Abano Terme-Montegrotto.

KEY WORDS: Regional geology, Geomorphology, Hydrothermal circulation, Euganean Hills, Italy.

RIASSUNTO: PELLEGRINI G.B. & SEDEA R., *I Colli Euganei: guida alla escursione*. (IT ISSN 1724-4757, 2005).

I Colli Euganei sono edifici subvulcanici estinti esumati dall'erosione, che ha rimosso la gran parte delle rocce sedimentarie e parte delle sottostanti rocce eruttive. Essi emergono dalla pianura alluvionale come rilievi isolati, posti a sud-est di Padova.

Nei Colli Euganei affiorano rocce sedimentarie marine di età compresa tra il Giurassico superiore e l'Oligocene inferiore. Le rocce eruttive appartengono a due eventi magmatici ascrivibili rispettivamente all'Eocene superiore (basalti) e all'Oligocene inferiore (rioliti, trachiti e latiti).

In questa escursione viene presentato e discusso un quadro aggiornato sulle caratteristiche geologiche, geomorfologiche e sulla natura delle acque del noto sistema idrotermale euganeo nelle classiche località di Abano Terme e Montegrotto.

TERMINI CHIAVE: Geologia regionale, Geomorfologia, Circolazione idrotermale, Colli Euganei.

The Euganean Hills rise from the alluvial plain surrounding them as isolated reliefs south-east of Padova (North-East Italy) (fig. 1). Alluvial deposits have occupied and submerged the lower parts of the slopes (Marinelli, 1922), separating and isolating the various «mountains» from each other and from the highest central relief, Monte Venda (601 m). The characteristic cone shape of many hills immediately reveal their eruptive origin (Piccoli & *alii*, 1981). However, they are not true volcanic forms, but rather the result of the exhumation, due to erosion, of subvolcanic masses which solidifed near the surface, under a sedimentary cover of mainly Cretaceous and Eocene age (*Scaglia rossa* and *Euganean Marls*). The magmatic manifestations which have dislocated, deformed and locally crossed the marine sedimentary rocks, initially subhorizontal, belong to two main intrusive events, dated respectively to the Upper Eocene (basalt) and Lower Oligocene (rhyolite, trachyte, latite). From the geological viewpoint, as demonstrated by radiometric studies, the Euganean eruptions took place over a relatively short time-span and ended in the Lower Oligocene.

The Euganean Hills are therefore extinct subvolcanic edifices exposed by erosion, which removed most of their thick sedimentary cover and part of the underlying eruptive rocks (figs. 2, 5 and 8; from Piccoli & *alii*, 1981, modified). Their main morphological feature is the contrast between the forms modelled in the sedimentary rocks defining the perimeter of the central part (fig. 1; from Astolfi & Colombara, 1990, modified), and those modelled in reliefs mainly composed of rocks of the eruptive cycle. The former, composed of small subhorizontal ridges or surfaces, are generally undulating, with modest gradients, and crown the main hills. The latter have conic and pyramidal forms, with steep but rounded slopes, and are often grouped in more complex and massive morphological units (e.g. Monte Grande-Monte della Madonna group) (figs. 4 and 5). However, there are several isolated cones, mainly in the peripheral area, in clear contrast with the flat alluvial plain surrounding them (fig. 3). The various gradients of the Euganean reliefs are easily explained by the different degree of resistance to weathering and erosion of the eruptive rocks, with respect to the sedimentary formations and basaltic tuff associated with them. Subaerial modelling, although acting for prolonged periods and in highly variable climatic conditions, was not completely

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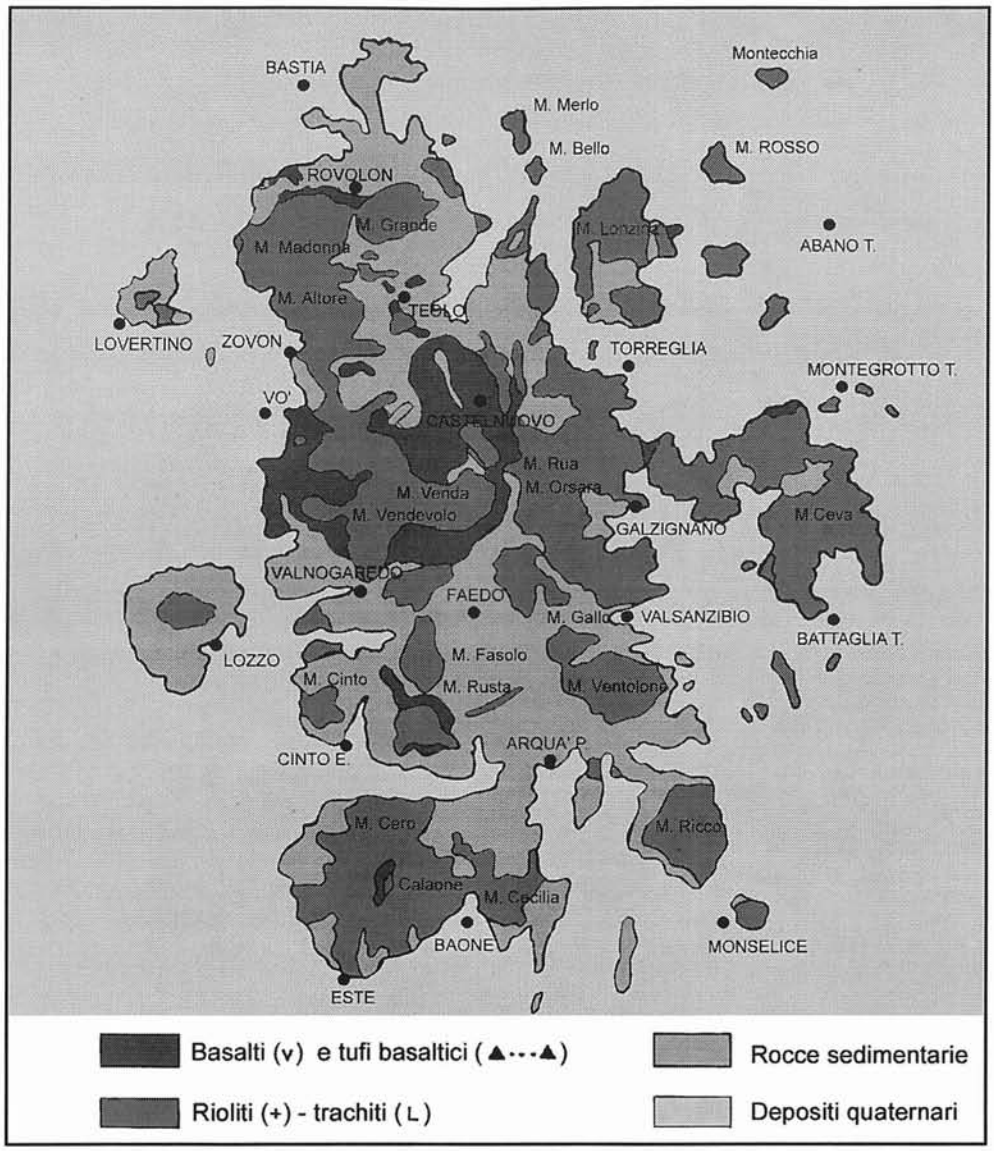

FIG. 1 - Simplified geological map of the Euganean Hills. The legend refers also to figures 2, 5 and 8.

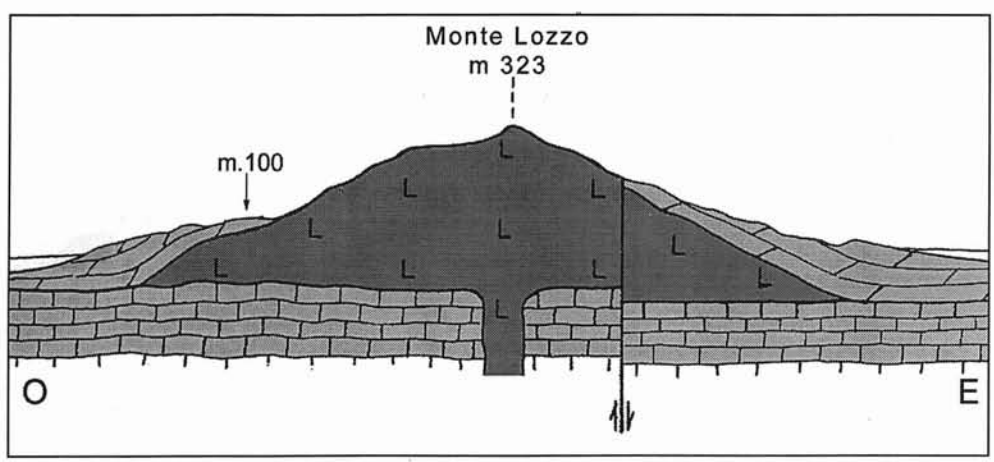

FIG. 2 - Geological section of M. Lozzo.

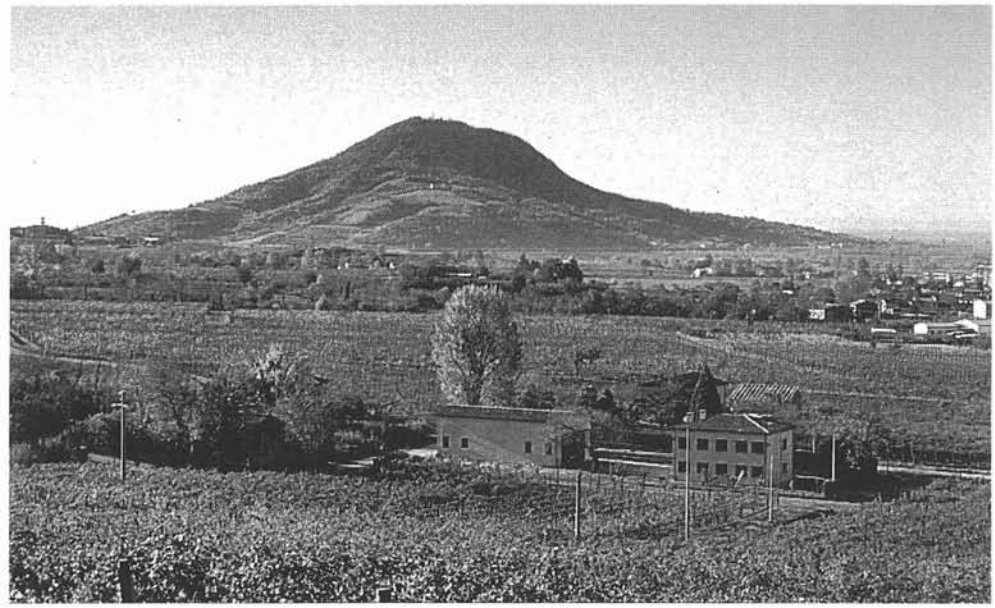

FIG. 3 - M. Lozzo conic relief rises completely isolated from the alluvial plain. The top of the hill is composed of volcanic rocks, whereas the surrounding slopes of sedimentary rocks. The trachytic lava, breaking through the sedimentary cover, gave rise to an eruption laccolith.

able to eliminate the initial morphological characteristics which had been transmitted to the hill system by endogenous factors (A. Girardi, in Piccoli & *alii*, 1981).

The many subhorizontal surfaces, which more or less regularly surround the largest reliefs at various altitudes, were attributed by A. Schlarb (1961) to at least three evolutionary phases of the whole group and were interpreted as evidence of larger erosion paleo-surfaces, clearly identifiable near the villages of Costa (near Arquà Petrarca), Lozzo (fig. 3) and Lauri, near Teolo (fig. 4). Although the correctness of this interpretation cannot be denied, more recent research, preceded by a profound critical analysis by F. Donà (1964), has shown that only a few of these surfaces are definitely due to erosion, since many of them are controlled by structural factors (Piccoli & *alii*, 1981).

The difference between the action of channelled waters (*calti*) which deeply cut the soft rock surfaces (marls) and that of running waters on slopes composed of hard rock are clearly shown on M. della Madonna, M. Grande, and the M. Venda-M. Vendevolo group. The lithological passage between hard and soft rock is even more clearly revealed by the transversal profiles of these reliefs, emphasized by a definite change in gradient at the point of contact between hard trachytic rock and the embedding

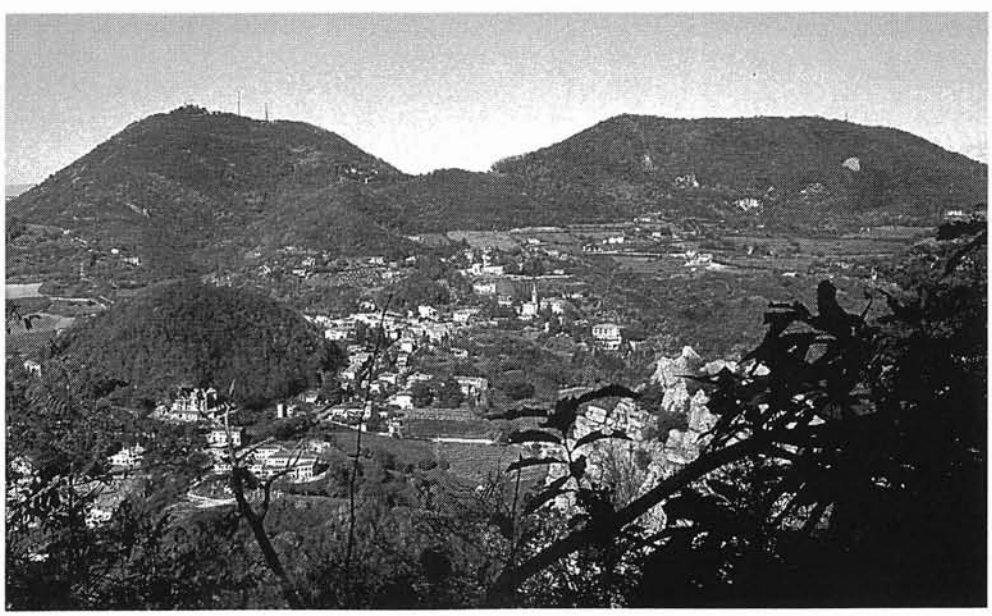

FIG. 4 - The M. Grande (on the right) - M. della Madonna group. At the foot of the trachytic relief there is the Lauri structural paleo-surface which is made of subhorizontal layers of *Scaglia Rossa*.

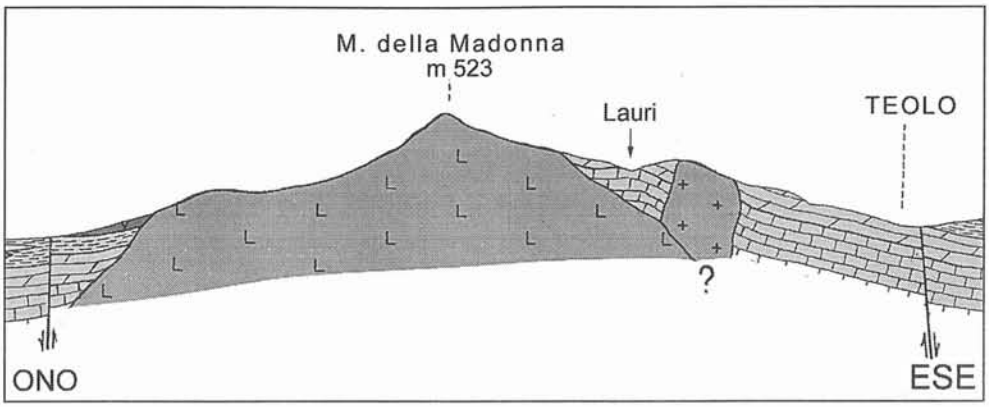

FIG. 5 - Geological section of M. della Madonna.

FIG. 6 - The small waterfall of Schivanoia, along *calto* Contea, between Castelnuovo and Teolo. The latitic lava (above) intruded into the Euganean Marls (below).

Scaglia rossa or *Euganean marls*. A typical example may be observed on the southern slope of the M. Grande-M. della Madonna group (fig. 4), where the sedimentary rock shows mainly discordant relationships with the volcanic rocks (fig. 5). The Lauri paleo-surface develops on the sub-horizontal layers of *Scaglia rossa*, recognizable at around 200 m a.s.l. (fig. 5). The contact with the eruptive rock may be seen slightly upslope from the stone quarry (southern slope of M. Grande), which also has very fine examples of columnar structure.

Monte Lozzo (323 m) is the best example of an eruption laccolith among those to be found in the Euganean Hills (figs. 2 and 3). This completely isolated hill rises from the alluvial plain, separated from the main group of hills by Quaternary alluvia which surround it entirely (western sector, fig. 1). The geological sketch-map (fig. 1) again highlights the fact that its core is composed of volcanic rock, whereas the surrounding slopes are sedimentary. Trachytic lava intruded into the rocks of the Biancone (below) and those of the *Scaglia Rossa* (above) and, breaking through the sedimentary cover, gave rise to an eruption laccolith. Erosion has removed the whole sedimentary cover from the summit, although traces of it may still be found on the subhorizontal surfaces which surround the lower part of the hill, identifiable around 100 m a.s.l. (fig. 2).

The highest relief in the Euganean Hills, M. Venda (601 m), together with the nearby M. Vendevolo (460 m), is interpreted as a rhyolitic endogenous dome (figs. 7 and 8). All around are outcrops of sedimentary rocks belonging to the *Euganean Marls* and basaltic tuff resulting from the first eruptive cycle (fig. 8).

Among the other phenomena which contributed to the intense subaerial modelling of these hills were gravitational processes. For example, debris falls gave rise to the scree slope around M. Venda, M. Vendevolo and M. della Madonna.

Ever since Roman times, the Euganean Hills have been extensively quarried for stone, the main source of building materials for the inhabitants of the nearby Venetian plain. The Euganean quarries (one of the largest and best-known is that of Zovon; fig. 9) provided mainly trachyte and rhyolite as ornamental stone, and limestone and marl as ce-

FIG. 7 - The southern slope of M. Venda (on the right) and M. Vendevolo (view from M. Fasolo).

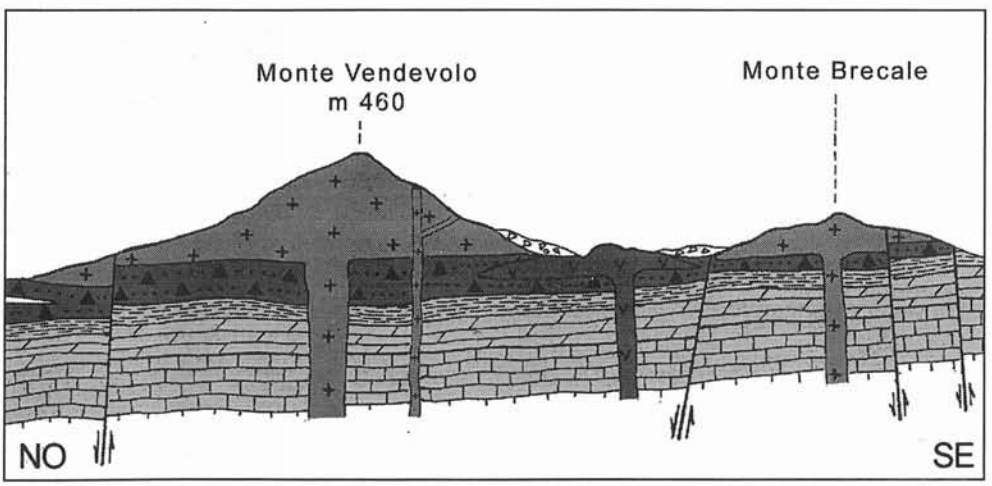

FIG. 8 - Geological section of M. Vendevolo and M. Brecale.

FIG. 9 - Columnar structure in trachytic rocks: a quarry near Zovon.

menting materials. At the present time, quarrying is controlled by laws to safeguard the particularly beautiful landscape. No new quarries may be opened, and a *Parco Naturale* has been established, comprising most of the Euganean Hills.

Fig. 10 shows the well-known euganean hydrothermal system of Abano Terme-Montegrotto. Recent geological and geophysical research in this sector of the Euganean Hills indicates that a complex system of faults developed, subdividing the deep sedimentary rocks into blocks, which are now the natural reservoir of the hydrothermal waters. The circuit is of geothermal type and is not directly associated with the volcanism which, as already mentioned, became extinct during the Tertiary (Piccoli & *alii*, 1981).

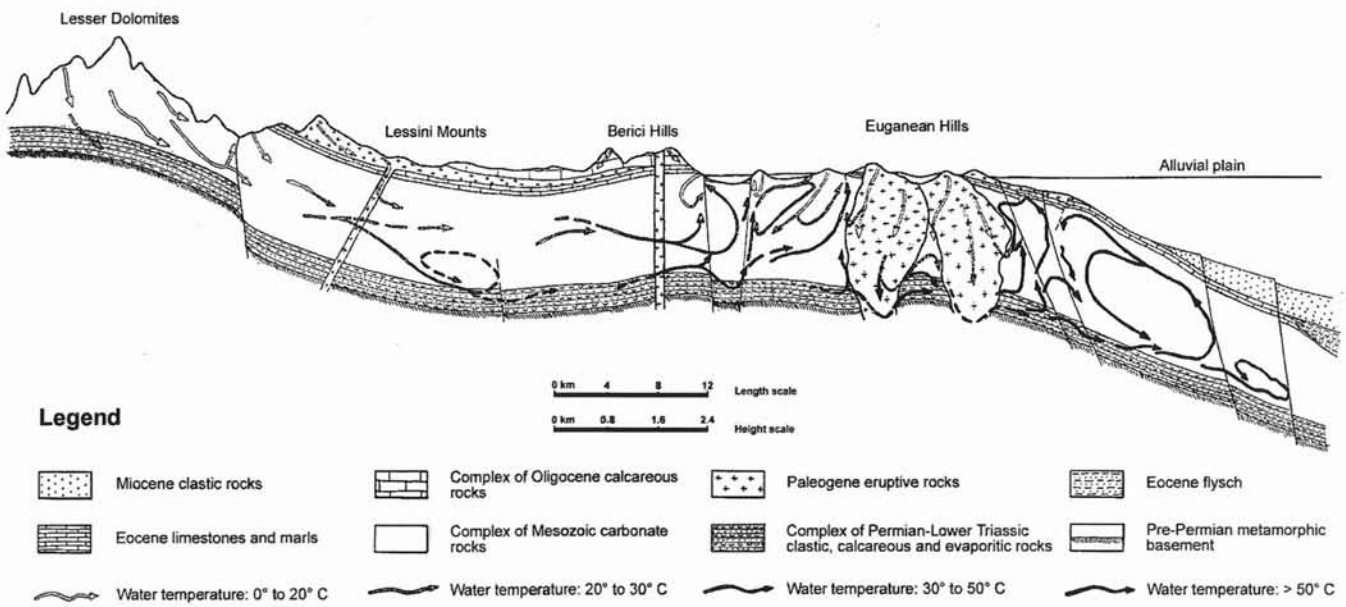

FIG. 10 - Scheme of the Euganean hydrothermal circuit.

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The proposed fieldtrip will articulate in the following itinerary and stops.

1. Padova, Villa di Teolo (marine sedimentary rocks crossed by Eocene and Oligocene magmatic occurrences).
2. M. Grande and M. della Madonna (panorama of Euganean Hills and surrounding plain).
3. Trachytic dyke of Rocca Pendice (short excursion, on foot, to examine some typical forms of selective erosion).
4. Break for lunch.
5. Zovon (quarrying of trachyte and gravitational processes).
6. Arquà Petrarca (visit to a picturesque Medieval village).
7. The euganean hydrothermal system of Abano and Montegrotto.