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# ALPONE VALLEY: FAUNAS, FLORAS AND ROCKS FROM THE CENOZIC

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## Abstract

In the Alpone Valley there are outcrops of volcanic and sedimentary marine rocks that contain many Eocene palaeontological deposits including those of Bolca. The fossils of Bolca have been known for a long time: the earliest sure records date back to a document dated 1550. Dates back to 1571 the important collection of the chemist Francesco Calzolari of Verona who in his museum, the first naturalistic museum known to the world, also exposed some fish from Bolca.

The great biodiversity and exceptional conservation, particularly of fish discovered in the two most representative localities of Bolca, Pesciara and Monte Postale, makes it the richest deposit in the world. In fact, the fish Actinopterygii known in the fauna of Bolca belong to 19 orders, 91 families, 192 genera (of which 32 are of uncertain family) and at least 220 species. In addition, Pesciara and Monte Postale, protected since 1990 by the Regional Natural Park of Lessinia, and other deposits in the Alpone Valley recently reported, are famous even for the rich flora of the Eocene (170 genera, 137 species of which 54 types), certainly one of the most important and various worldwide and for the well preserved rests of reptiles, birds, scorpions, insects, jellyfish, crustacea, bivalves, gastropods, cephalopods, corals, brachiopods, annelids, foraminifers, ostracods and bryozoa.

The palaeontological heritage of the Valley, which is preserved in some small local museums and in the main Italian, European and extra-European museums, has an important role in the History of Science and it offers a large window of knowledge about ancient landscapes of the Earth and their evolution. All this makes the territory of the Alpone Valley a reference point for those interested in Palaeontology, thanks to fossiliferous localities known worldwide, in particular as regards the marine and continental Eocene.

**Keywords:** cultural heritage, geoenvironmental resources, museums, geosites, exploitation.

## Introduction

Since 2014, following a number of research initiatives and studies on the area of Alpone Valley, some institutions have begun to evaluate enhancement of naturalistic and cultural heritage in this territory.

This has gone up an association made up of the institutions of the valley (Vestenanova, San Giovanni Ilarione, Montecchia, Roncà and Monteforte, Altissimo, Crespadoro, Gambellara, the Regional Natural Park of Lessinia, the Route of Durello Wine) and integrated by research institutions (Museum of Natural History of Verona, University of Verona, the City of Verona Unesco Office).

Association's goal is to bring the insertion of the Alpone Valley in the Unesco Italian tentative list and develop a coordinated plan for the enhancement of local resources.

## Geographical and geological framework

Alpone Valley (Fig. 1) is the easternmost incision of the Monti Lessini Veronesi (Venetian Alps). The valley is mainly set in volcanic rocks, and pyroclastic eruptions of basaltic nature, while outcrops of sedimentary rocks of

the Cretaceous (Scaglia rossa Veneta) and Eocene (nummulitic limestone), of limited thickness and extent, are more present in the northwestern part.

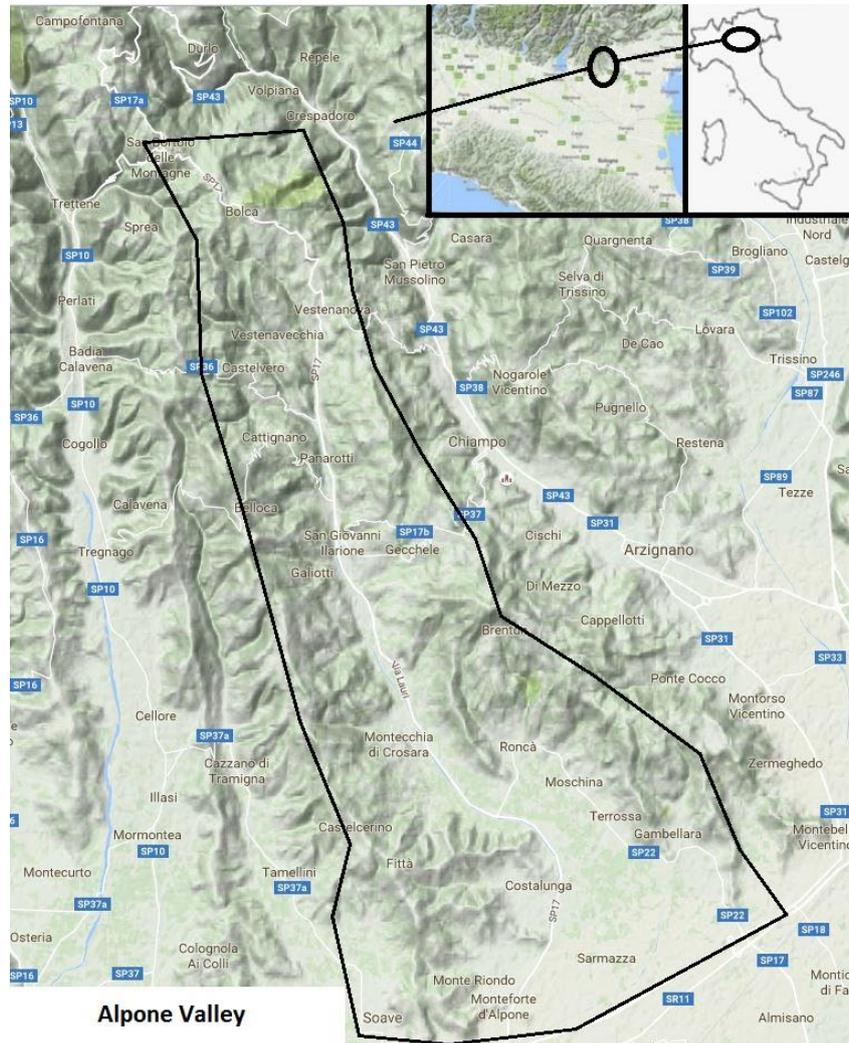


Figure 1. Northern Italy with the indication of the Alpone Valley.

In the world this area is known to scholars of Paleontology and Geology for its extraordinary number of well-preserved fossils of the Eocene period and also for the great variability of volcanic phenomena that have affected it in the past.

There are many geological and paleontological studies involving deposits of basaltic rocks and fossil localities of Bolca, Roncà and San Giovanni Ilarione, protected since 1990 by the Regional Natural Park of Lessinia. The extensive and several volcanic eruptions in this eastern portion of the Monti Lessini Veronesi, mainly during the Eocene, are documented by a lot of outcrops of basalt and volcanoclastic products that have been variously modeled during geologic periods.

On the eastern mountain slope of Alpone Valley are clearly visible remains of some large subaerial volcanic structures, including Mount Calvarina that, together with the Mount Crocetta and Mount Duello, shaped a large active volcanic group that emerged from the ancient Tethys ocean, about 40 million years ago. In Bolca are also known other volcanic mountains, locally known as "*purga*" (Bolca, Vegroni and Durlo), made up of rocks that have been shaped, between the Eocene and Oligocene.

The geological and paleontological heritage of the Alpone Valley is exposed in two important local structures: the Fossil Museum of Bolca (Fig. 2) and the Paleontological Museum of Roncà.



Figure 2. The Fossil Museum of Bolca.

The visit to these two structures can be completed with a "Walk Paleontology" that allows visitors to carry out a specific circle path on different levels of learning, each starting at the local museum. As for the Fossil Museum, the route variants have specific information, with panoramic rest areas where, in the various message boards, are provided thematic topics. The longer route, which is spread over 9 km and an altitude difference of about 405 meters, requires 4 hours of walking. The different points of view affecting: a) the Mount Postale, b) the Pesciara with its galleries, c) Mount Purga of Bolca with the basalts and the layers where, in 1946, were found a beautiful specimen of crocodile and of a turtle, d) Mount Spilecco where is located the oldest deposit of the field. The walk also presents historical places, crossing Brusaferrì and Loschi hamlets, while, on top of the ancient volcano of Monte Purga, people can enjoy a breathtaking view of Alpone Valley and of the nearby Euganean Hills.

### **Alpone Valley: a valley rich in history and fossils**

Numerous fossil deposits of the valley are known by many centuries and they are known for their great variety of artifacts that are found there and for their wonderful state of preservation. Dating back to 1550, the work of the Sienese doctor Andrea Mattioli "Discorsi sopra Dioscoride", that is the first documented reporting of fish fossils of Bolca. We can read about this: "... *... Ricordomi oltre à cio essermi stato mostrato dal Signor Don Diego Urtado di Mendoza, oratore Cesareo à quel tempo in Vinegia, alcune laste di pietra state portate del Veronese, in cui (sfendendosi per mezo) si ritrovano scolpite diverse spetie di pesci con ogni lor particola conversa in sasso*": o di cotali affermava sua Signoria ritrovarsene numero infinito la ove quelle erano state cavate. Tanto grandi, o meravigliose sono le opere della natura. ...". This demonstrates how the fossils of Bolca were known for long time ago, and we can suggest that they were part already in some private collections. In fact, right in the '500 we have the first natural history collections.

It dates back to 1571 an important collection by the pharmacist Francesco Calceolari. Collection was composed by various materials including some fossils of Bolca fish. The Natural Museum of Francesco Calceolari was described in 1584 by the physician in Modena G. B. Olivi and it is now considered the oldest in the world. One of the copies of Calceolari collection is still kept at the Section of Geology and Paleontology of the Natural History Museum of Verona.

In the second half of 1600, the paleontological heritage of the central portion of the valley attracted the attention of Martin Lister, an English geologist and naturalist who, in his *Historia Conchyliorum* (1685-1692) explained the *Buccinum musicum* and *Buccinum B. majus*, gastropods coming from the territory of Roncà (Val Cunella). Later, in 1742, Niccolò Gualtieri, zoologist and Florentine physician, outlining three copies of *Conchyliorum* from Roncà while, Antoine-Joseph Dezallier d'Angerville, Parisian lawyer, described in a treatise six species of shellfish, near Roncà.

Just over a century later, some scholars started to analyze the stratigraphy and paleontology of the "horizon of San Giovanni Ilarione". We refer to Edmond Hébert, Francesco Molon, Ernst Munier Chalmas and Ferdinand Bayan. The latter, in 1870, after a series of surveys, collected fifty different shellfish, recognizing 18 of them, as a new species, typical for San Giovanni Ilarione. Munier (1877), however, reported the presence of abundant remains of corals, echinoderms, crustaceans and cephalopods. The most extensive discussion of malacofauna of San Giovanni Ilarione is due to Paolo Vinassa de Regny (1895-1897) who, in addition to illustrating with beautiful paintings the fossil records, described about forty new species of mollusks.

In the twentieth century, however, the mining of coal cultivation activities (lignite) near Bolca and in particular those of Purga Mount (Fabiani 1912 and 1915) and Monte Vegroni, enabled the discovery of important fossil deposits of freshwater or land molluscs, attributable to approximately 40 million years ago, and palms (*Latanites*, *Phoenicites*, etc.), turtles (*Trionyx*) and crocodiles (*Crocodylus vicetinus*).

### **Fossils: a priceless heritage**

Pesciara, Postale Mount, Spilecco, Serea Mount, Ciupio, Duello Muont, Purga Mount/Vegroni Mount, Praticini, Loschi, Cà Tessari, Costo and Possette are just a few of the many deposits that for centuries have attracted the interest of scholars and collectors. The Pesciara and Postale Mount are, of course, the Fossil-Lagerstätten ypresiane most famous and important in Italy if not Europe and the world (Papazzoni et al. 2014). These are two deposits just a few hundred meters from each other, of marine origin, and with fairly similar characteristics. In fact, the faunas are similar, although the Pesciara can be considered the symbol site of the Italian Paleontology, since the twentieth century excavations and research activities have affected almost exclusively this place.

The great biodiversity and the exceptional preservation, especially of fish (Fig. 3), found in the two most representative locations in Bolca (Pesciara and Postale Mount), makes it the richest deposits in the world. Each excavation gives new findings for Paleontological Science. We can remember that Jacques Blot in 1980 published a catalog which updated the previous one, drawn up by D'Erasmus (1922) in which nominal lists 208 species belonging to 117 genera included in no less than 72 families. The systematic of Bolca fish fauna has been changed and increased considerably through the contributions of various scientists in many publications. The most recent list was made by Bannikov (2014) according to which the Actinopterygii fish known in Bolca fauna belonging to 19 orders, 91 families, 192 genera (of which 32 are of uncertain family) and at least 220 species. Among these, the Acanthomorpha are represented by 11 orders, 78 families, 163 genera and at least 190 species.

In addition, the Pesciara and Postale Mount, and other sites of the Alpone Valley recently discovered, are famous: a) for the rich Eocene flora (170 genera, 137 species of which 54 types), certainly one of the most important and various in worldwide; for the well preserved remains of reptiles, birds, scorpions, insects, jellyfish, crustaceans, bivalves, gastropods, cephalopods, corals, brachiopods, annelids, foraminifera, bryozoans and ostracods.



Figure 3. *Sparnodus vulgaris*.

The geological and paleontological heritage of the valley is stored as well at the Bolca Fossil Museum and at the Paleontological Museum of Roncà, as and in major Italian museums. Furthermore this heritage has an important role in the History of Science outside Europe also, and offers a great window of knowledge on ancient landscapes of Earth and their evolution. All this makes the territory of the Alpone Valley a reference point for those interested in paleontology, thanks to fossil localities known in the world, in particular with regard to the marine and terrestrial Eocene.

### **Human landscapes and cultural heritage of Alpone Valley**

In the territory of the Alpone Valley we can observe sites that testify human presence in a long period, from stone age to bronze period. About these phases, however, we still know little. In more recent times the human presence begins to be denser: the sites of the valley dated to the Iron Age are at least six. They are located on the Monte Purga di Bolca, one of the Three Cime of Prealta, Mount Soeio, Mount Madarosa, Mount Calvarina and Mount Zoppega. Most of these are only known through casual recovery of surfacing material and therefore do not know in detail the evolution of settlement and the abandonment or causes of the end of the sites. Only two (Mount Zoppega and Mount Soeio) were affected by archeological survey (Fig. 4) and investigated with the excavations (Mount Soeio and Mount Madarosa).



Figure 4. Archaeological excavations to the Terrossa castle (XIII-XV century).

Population changed in roman times: the presence of the consular street must have certainly influenced the settlement dynamics of the Roman era. In fact, although the path of the road is not certain, its route is clearly legible, looking at the alignment with which the archaeological evidence of the lower valley are arranged. The population changed and the hilly sites were abandoned in this period.

In the medieval period the landscape of Alpone Valley was at the border between the administrative territories of Verona and Vicenza. Scholars only for the later phase of the Middle Ages are able to formulate concrete hypotheses about the possible boundary.

The area of the Alpone Valley becomes zone of influence and power of important noble families such as that of St. Bonifacio or Maltraversi, laying on these territories important bases for their land and economic development. During this time the landscape is built around the villages, churches and castles whose remains are preserved and visible in the area. One of these castles (Terrossa, near Roncà) has been archaeologically investigated in the last five years, showing a small fortified village, with houses and towers.

### **Some notes about the project**

This project shows how the Alpone Valley is an outstanding examples representing an important stage of earth, to which is added an outstanding example of a traditional human settlement. The establishment of the association and research initiatives carried out until today, are only the first step in enhancing the area and its outstanding natural and cultural resources.