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EVOLUZIONE GEOLOGICA E GEODINAMICA DELL'APPENNINO

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Abstracts

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The older level, particularly evident in the Macerata and Teramo areas, can be observed at the base of Globorotalia crassaformis Zone (Lower Piacenziano). According to some Authors, its deposition coincided with the deterioration in climate at 3 Ma BP, evidence for which can be had both from isotopic analyses and from variations in the composition of the foraminiferous associations. Instead, other Authors maintain that the particular environmental conditions were set up with the infrapliocene regressive event, connected with the then active tectonics, which formed submarine sills that altered the circulation and thereby created asphyxiant conditions. A second horizon, similar to that of the Lower Piacenziano, can be observed at the transition between the Pliocene and Pleistocene; this, too, is attributable to tectonics or climate.

For the purpose of correlations, the discontinuity surfaces, present in various levels of the succession, can be very useful; to the top and bottom, they delimit the depositional sequences. As is well known, these can also lead to correlations of a regional significance, in that they are correlated with tectono-eustatic factors. The most important of these discontinuity surfaces, which allow large-scale correlations to be made, are four in number. The oldest one separates the Pliocene fossiliferous clays from the dark clays of the Messinian. A second surface, generally marked by a considerable angular unconformity, can be observed in the Lower Piacenziano (at the base of Globorotalia crassaformis Zone). A third one lies at the Pliocene/Pleistocene boundary, while the most recent one separates the Emilian sediments from those of the Sicilian.

In addition to those mentioned above, other surfaces are to be found in the studied succession at various stratigraphic heights; these, even if assume a more local significance, allow further correlations to be made.

Yet a further correlation element emerges from the study of the geometry of the coarse-grained bodies intercalated in the Plio-Pleistocene pelitic succession. These geometries are connected to variations in grain-size and in the thickness of the layers, as well as to the sand-pelite ratio. The values of these parameters decrease progressively proceeding from the point where the gravitational flows enter the basin towards the most distal areas. A careful and detailed geological survey would undoubtedly allow the lateral facies variations to be followed, and thus the limits of the bodies to be defined.

With respect to other investigatory methodologies, paleomagnetic analysis offers, as is known, a greater resolution. Since it allows time intervals of the order of thousands of years to be identified, the method is particularly effective when applied to a depositional context like that of the Periadriatic Basin , which is characterized by a high sedimentation rates, in

which considerable thickness of sediment goes together with short periods of time.

STRUCTURE AND DEFORMATION HISTORY OF THE STAZZEMA ZONE, SOUTHERN APUANE ALPS

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The interpretation of the structural setting of the Apuane Alps Metamorphic Complex (AMC) and the reconstruction of the related tectonic history during the Tertiary orogenesis are still matter of discussion among researchers involved in the northern Apennines geology.

Particularly, in the southern part of AMC the Stazzema Zone shows a complicate tectonic setting and the presence of series of imbricate sheets that make problematic the reconstruction of the stratigraphic succession.

To the S, SE and E, the Stazzema region is bounded by the ridge Gabberi-Gevoli-Matanna-Nona-Croce mounts (from SW to NE). Along the northern and western slopes of these mountains, the oldest (Triassic) formations of the Tuscan Nappe crop out persistently. From this ridge the area extends toward the NE and the N up to Mt Forato-Pania della Croce, Foce di Mosceta and Mt Corchia, and its western boundary is represented by the dolomitic level from Mt Corchia to Mt Gabberi.

The first geological mapping of the Stazzema Zone was performed at the end of last century by Zaccagna (1891-96, Mount Altissimo sheet of I.G.M. map series at scale 1:25000). According to this author, the Stazzema metamorphic rocks form the so-called "Zona degli scisti superiori" (Permian-Triassic) which stratigraphically overlies the "Zona dei marmi" and is involved in a large-scale SE-facing fold.

Later, Masini (1937) and Merla (1952) radically changed the stratigraphic framework proposed by Zaccagna. The two authors highlighted that, some rocks indicated by Zaccagna as "scisti superiori" are older than

the marble formation, and that some stratigraphic limits of Zaccagna are tectonic contacts.

In the sixties, during the surveys to prepare the 2nd Edition of the sheet Massa of the Geological Map of Italy, scale 1:100000, the tectonic setting of the Apuane Alps region was more clearly stated and the rocks cropping out in the Stazzema Zone were grouped in a set of tectonic slices, the so-called "Parautoctono dello Stazzemese" (Trevisan, 1962; Nardi, 1963).

Since the seventies, only a few works have been addressed to the geological problems of this area. Among papers that marginally focused on the Stazzema Zone structure and its tectonic evolution, we mention the works of Carmignani et al. (1976), Carmignani & Giglia (1975, 1983), Ciarapica et al. (1985), Cortecci et al. (1985), Passeri (1985), Carmignani & Kligfield (1990), Carmignani et al. (1993), Ciarapica & Passeri (1982, 1994). Referring to the last four papers, two largely contrasting reconstructions are presented.

According to Ciarapica & Passeri (1994, and ref. therein), the present structure of the Stazzema Zone resulted from the following tectonic events:

* top-to-ENE thrusting of the Panie Unit over the AMC;
* top-to-SW back-thrust of the Pescaglia Unit (the "zona toscana interna" of the authors) over the two preceeding tectonic units, already coupled. As consequence of this event, the AMC and the Panie Unit are involved in a large-scale, SW-facing recumbent antiform and underlying synform;
* development of low-angle normal faults with top-to-SW kinematics, pertaining to the disjunctive tectonics which led to the denudation of the AMC and to its subsequent uplift.

Alternatively, the reconstruction of Carmignani & Kligfield (1990, and
ref. therein) envisages that:

* in the Stazzema Zone, the old and young levels are the cores of sheath-shaped and ENE-facing anticlines and synclines, and these last developed during the compressive tectonics (D1);
* one of the former structures is the Grezzoni-cored Panie anticline (Bigazzi et al., 1988), that at the end of the D1 is placed on top of the underlying pile of coeval anticlines and synclines. All these D1 folds belong to the AMC;
* during the extensional tectonic phase (D2: first stages of the Apuane uplift), the huge carbonatic body of the Panie anticline moves eastwards along a detachment surface inclined to E and NE,;
* as effect of this motion, all the underlying D1 folds are so higly tectonized, that their flanks suffered severe lamination and milonitic deformation along more or less important shear zones.

New field mapping provides new data to support the second reconstruction, and stir up the scientific debate on one of the most controversial and questioned themes in the Apuane Alps geology.

LATE OROGEN-PARALLEL COMPRESSION IN THE NORTHERN APENNINES?

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The Northern Apennines is a fold and thrust belt characterized by the northeastward propagation of the deformation. During the main collisional event, responsible of the stacking of the main tectonic units, folds and thrusts develop with a main NW-SE trend.

Several transversal structures have been recognized, mainly represented by strike-slip faults and folds. One of the most striking transversal fault is the one located in the northern side of the Apuane Alps, at the boundary between the Tuscan Nappe and the metamorphic rocks of the Apuane Alps complex.

It trends nearly ENE-WSW and it develops for few dozen kilometers. Kinematic indicators show a dextral strike-slip sense of movement. The curved pattern of the fault surface induces a complex deformation path. In particular the left bend located in the Teneranǫ area allows the development of a wide zone of transpressive deformation mainly in the Tuscan Nappe.

Strike-slip faults affect the metamorphic rocks of the Apuane Alps and Monti Pisani area. Other transversal structures are represented by upright folds, recognized in the Tuscan Nappe outcropping in southern termination of the Apuane Alps and in the Monti Pisani area.

The direction of shortening related to these structures, both folds and faults, is roughly oriented NW-SE, i.e. parallel to the main trend of the Northern Apennines belt.

This orogen-parallel compression, superposed over prevoius folds, may play an important role in the development of metamorphic domes in the Northern Apennines.