

Forearc-dipping normal faulting in Central-Western Peloponnesus, Greece

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Forearc-dipping, orogen-parallel low-angle extensional faults have been described in various orogens, including the Apennines, Italy and, recently, southern-central Crete, Greece. Such a fault system is also present in the central-western Peloponnesus, in the south-western Aegean Arc. It comprises low- and high-angle normal faults which control the western border of Mt Mainalon. The Alpine nappe sequence of the studied area includes the metamorphic rocks of the Phyllites-Quartzites Unit (PQ), overlain by the carbonates and flysch of the Gavrovo - Tripolis Unit, which also overlies the Ionian Unit to the west. The uppermost nappe is the Pindos Unit, which is a sequence of Mesozoic pelagic limestones and clastics, topped by a Paleocene flysch.

Most of the extensional structures were previously thought of as the original thrust contact between the Pindos and Tripolis Units. However, our geological mapping and the cross-cutting relationships among these structures indicate that these are SW-dipping faults – their dip, in other words, is towards the arc- and they downthrow the original Pindos thrust by a few tens or hundreds of meters each. Some of these faults sole into the underlying thick Tripolis flysch, but most of them reach deeper, affecting the contact between the flysch and the carbonate platform. In SW Mainalon we mapped low-angle normal faults that juxtapose the metamorphic rocks of the PQ Unit against the non-metamorphic sequence of the Tripolis Unit. High-angle normal faults found further to the west have truncated or even sole to the low-angle ones. The whole extensional fault architecture has resulted in the Pindos thrust stepping down from altitudes higher than 1000 m in Mainalon, to negative heights in North Messinia and southern Iliia; and the gradual disappearance of the Phyllite-Quartzite metamorphics of Mainalon towards the west.

In the north-west, these faults are truncated by NE to NNE-striking, NW-dipping faults, which transfer the whole fault system towards the north, where it forms the eastern boundary of the Pyrgos graben. On the other hand, the south-eastern members of this fault system are truncated by E-W to ENE-WSW faults, which relay fault activity to the eastern boundary of the Megalopolis basin. All these extensional structures form the eastern boundary of the Megalopolis-Lycaion-Minithi-Tetrazion (MeLyMiTe) and the Pyrgos tectonic depressions, which in turn are separated by the E-W Lapithas horst, at the western end of which the Ionian Unit crops out. The northern and southern boundaries of these tectonic depressions are controlled by oblique-normal faults, perpendicular to the eastern boundary. The throw of these faults increases towards the west and the interplay of all these faults has led to the composite deformation pattern of the MeLyMiTe, which displays extension on its flanks and compression in its centre.

The combination of these extensional faults (which may reach down to the Ionian decollement) with the low-angle floor thrusts of the Pindos, Tripolis and Ionian Units leads to additional ENE-WSW shortening, normal to the Hellenic Arc, west of the Peloponnesus.

The origin of color in minerals and gems

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We explore the cause of color in the mineral world from the smallest (isolated ions) to the largest (a full crystal). Many mineral colors originate in absorption but occasionally

physical optics get involved. Several causes are usually mixed together, however often one dominates the others, which then merely provide a nuance to the general color appearance.

Isolated ions from the first series of transition elements are undoubtedly the most common cause of color in minerals and gems. They may be a component of the mineral, which is then intrinsically colored, or simply appear as impurities, which is often the case in gems. The major elements involved are vanadium (V), chromium (Cr), manganese (Mn), iron (Fe) and copper (Cu), and to a much lesser extent cobalt (Co) and nickel (Ni). Rarely, rare earth ions may also be at the origin of the tint (mostly cerium (Ce), praseodymium (Pr), neodymium (Nd) and uranium (U)). At planetary scale, iron dominates by the sheer volume of rocks it colors. Important factors include the identity of the element, its valence state, the nature of the ligands (mostly oxygen, though), the coordination (octahedral, tetrahedral or otherwise) and the details of the environment of the ion at the atomic scale (the “crystal field”). For example Fe_{2+} often gives a bottle-green tinge to minerals (such as peridot and some amphiboles) and Cr_{3+} emerald-green colors, but both may also induce a purple-red tint (respectively in garnet and ruby).

Color centers result frequently from natural irradiation, and may be treated as pseudoatoms. They could be intrinsic defects (for example a vacancy: the neutral carbon vacancy colors diamond blue). But often, such defects trap impurities. Diamond and fluorine are colored almost exclusively by color centers. One of the most complex examples is amazonite, the turquoise-blue potassium feldspar, colored by a combination of lead and water.

There is a charge transfer when several atoms forming molecular orbitals are involved in light absorption. It may happen between two atoms (oxygen-“metal”) or a more extended cluster. These processes are often very directional, inducing strong pleochroism. They are also very efficient: a small concentration of clusters (10 to 100 ppm) may induce a strong, broad absorption, as is the case for the blue color of sapphire caused by Fe-Ti charge transfer. However, on the contrary to common belief among gemologists, the Fe-Ti charge transfer confers more often a brown tint. The $Fe_{2+} - Fe_{3+}$ charge transfer gives a blue color to many minerals and gems (cordierite, some aquamarines and sapphires, blue amphiboles, etc.)

A small number of gems have invariable intrinsic colors explained through band theory, which involves all atoms in the crystal: these could be metallic gems (“marcassite”, actually pyrite), semimetals (graphite, a common inclusion) or semiconductors (cuprite or red sulfides).

Relatively rarely, the electronic structure is not involved, but rather the texture of the mineral, through optical effects. Diffraction is well-known in opal and labradorite, but scattering may be comparatively more common in gems (moonstone, blue chalcedony and agate, blue and violet halite, etc.) or even contribute to some rock tints. Finally, a mineral might color another as an inclusion (hematite makes near-colorless feldspars and quartz red) and poorly crystallized silica (agate, common opal) is almost only colored by inclusions.

Types of lithological sequences and successions in the tuff and gypsum subformations of low Badenian from Piatra Verde (Slănic-Teișani)

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This paper presents the diagnosis and interpretation of the sulphatic-evaporitic facieses from the Southern side of Eastern Carpathians, Slănic syncline, in Badenian deposits at Piatra Verde. The succession of evaporitic facieses, with different gravity flow stages facies modelling and basin evolution by means of sequential stratigraphy.