Plate tectonics of the Mediterranean area and its mountain belts

Understanding the motion of tectonic plates helps us assess the long-term hazard associated with earthquakes and volcanoes on a global scale. This is particularly true of the Mediterranean area, the site of several active plate boundaries and one of the most densely populated, developed areas on Earth.

The Mediterranean area is characterized by a collage of small tectonic plates that are surrounded by arcuate mountain belts (Fig. 1). These are the sites of both active and ancient plate boundaries, including several volcanic arcs and oceanic basins. What makes these microplates unusual is their mobility and deformability: they show distributed deformation up to several hundreds of km from their mutual boundaries that has lasted over times approaching the duration of their motion. The motion of these plates therefore defies description by classical plate tectonic theory.

To circumvent this problem, our group is synthesizing information from various sources to arrive at a coherent movement picture for. Our approach combines well-established methods of structural geology (balanced cross sections across deformed zones, strain analysis, kinematic studies), petrology (pressure-temperature determinitations), and geochronology (biostratigraphic and isotopic dating) with state-of-the-art geophysical imaging of the mantle (teleseismic and local earthquake tomography) and remote-sensing of the surface.

We have published an initial series of plate reconstructions for the Western Mediterranean area that demonstrate the effects of the independent and intermittent motion oft he Adriatic microplate with respect to both the African and European plates since Cretaceous time. Currently, we are working on a detailed reconstruction of Adria's motion and its effect on the evolution of the Alps, Carpathian and Dinaride mountains. One of our prime concerns is to relate surface motion to the dynamics of subduction through time.

Looking to the future, we want to improve our knowledge of surface and subsurface geology in areas where data are rare or lacking. This includes structural studies in the Dinarides, ship-based seismic surveys in the Adriatic Sea, and a new research initiative (AlpArray), which aims to deploy a dense network of broad-band seismometers in the Alpine region.

Abstracts

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