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The three rules of the tectonic evolution of the Northern Apennines of Italy and their seismotectonic implications

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Since Lower Miocene (Late Burdigalian) the tectonic evolution of the Northern Apennines and of their hinterland region, the Northern Tyrrhenian Sea, is characterised by the contemporaneous activity and eastward migration of coupled compression (in the foreland) and extension (in the hinterland). This concept has been confirmed by the results of the CROP03 project, imaging the present-day crustal structure of the region as composed by two structural domains, an internal Tyrrhenian domain, dominated by extension and an external Adriatic domain, dominated by compression. However, the same data were also used to propose an alternative interpretation, denying any substantial Tertiary extension of the Tyrrhenian domain.

Many different geodynamic models have been proposed to explain this peculiar tectonic setting and evolution. Our aim here is to illustrate how the time and space relationships between compression and extension, expressed through three main rules:

1. at any time, compression and extension are contemporaneously active, in the foreland and in the hinterland, respectively;
2. at any position, extension follows compression;
3. extension can occur in the uppermost crust at the same time and position of compression at greater depth (lower crust and upper mantle).

We firstly describe the crustal structure of the Northern Apennines, considering the results of the CROP03 project, integrated by new geophysical data-sets, made available

after the conclusion of the project (e.g. stress maps of the Apennines, seismological data, strain vectors inferred by GPS data, palaeomagnetic data, structure of the lower crust and upper mantle).

In greater detail, we synthesise and discuss two complex data-sets, describing the tectonic setting of the Northern Apennines over two very different time spans:

- the age of the syntectonic basins (both hinterland and foreland), constraining the tectono-sedimentary history of the region since Late Burdigalian (17 Ma);
- the space distribution and kinematics of instrumental seismicity recorded in the last 20 years, that is an instantaneous image of the present-day evolution of the Northern Apennines.

Using this approach, we try to explain the tectono-sedimentary evolution of the Northern Apennines, its present day crustal structure and seismotectonic setting as the result of a coherent and quasi-continuos evolution, started about 17 Ma.