An approach to the structure of the Mediterranean Area : a satellite Photogeological study

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Résumé : L'étude des images du satellite Landsat-1 a permis de mettre en évidence de nombreux linéaments. Ceux-ci sont interprétés comme des décrochements récents liés à la collision continentale Afrique-Europe et à la fragmentation des masses intermédiaires.

The study of about 700 images taken by the Landsat-1 satellite has been used to draw a photogeological sketchmap of the Mediterranean realm. The interpretation of this imagery enables the major structural features of the margins of the Mediterranean deep basins to be outlined. A great many lineaments can be recognized ; their trends and distribution in the different geological provinces are not haphazard : a) - Many of these lineaments cut through more recent tectonic units : they have to be put in relation to recent deformations ; b) - Nevertheless they are much denser in the areas where pre-Cenozoïc rocks outcrop than in the big sedimentary basins. Thus they partly correspond to old (Paleozoïc or Mesozoïc) structures that have recently been reactivated, especially on the margins of the basins ; c) - They do not correspond to superficial structures (overthrusts, nappes) but probably to deep crustal structures. It is too early to conclude this study which needs additional work, i.e. comparison with detailed geological or geophysical maps, studies on the field, processing of satellite-recorded magnetic tapes. But we can emphasize the following points :

1. In spite of the difficulties of interpretation, the major systems of lineaments can be considered as wrench faults, and the importance of these horizontal shears is probably greater than generally admitted :
   - some good relations exist in the bathymetry, i.e. the structure of the deep basin margins (Tyrrhenian, Siculo-Tunisian threshold, Valencia trough, etc...) ;
   - the extension of structures from autochthonous to allochthonous areas raises the problem of the true size of the allochtonous domain under the tectonic pile in the different areas of the Alpine belt ;
   - especially the great arcuate systems of the Alpine belt in the Mediterranean seem to be related to such lineaments.

   So we have to raise the following questions : what is the amplitude of horizontal displacement ? What are the ages of activity ? Are they responsible for sedimentary changes of facies ?

2. If we consider that the Mediterranean-Alpine area is in a state of continental collision since the Maestrichtian and if we agree with the idea of fragmentation of continents, the major lineaments can reflect the trace in the morphology of the major faults initiated by this fragmentation. Thus the maps which have been drawn can be used to help field studies ; by their synthetic view they enable the major line of weakness to be situated.

These lines express the result of different stresses that occurred in the geological history. The stress orientation is much more important to know than the orientation of lineaments. So further studies in the field are now necessary to understand the stress pattern which has caused the movement along these linear features. An example of such a field study made in S.E. Turkey shows that a structural analysis based on the observation of minor features associated with the Landsat lineaments (shear planes, stylolites, associated folds, tensional joints) furnishes very useful data. It confirms, for example, that since the Maestrichtian Anatolia and Arabia have been subjected to the same stresses. The stress orientation for different periods is in accordance with the general kinematics deduced from the study of Atlantic magnetic anomalies ; but here the determination of the directions of shortening or lengthening and their chronology can be much more precise.

In conclusion, a photogeological sketchmap and field studies are complementary : onland work enables us to understand (and in some cases to predict for other areas) the structures associated with the major lineaments observed by satellite.