STRUCTURAL LINEAMENTS AND TECTONICS OF THE MEDITERRANEAN BASIN

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Abstract: Crustal lineaments have been identified with the aid of Landsat images in the Mediterranean Basin. An analysis of their length, shape, and orientation suggest the capability of identifying their genetic character: tension, compression, or shear. The orientation and the genetic character of the lineaments suggest widespread cruatal subsidence in the Mediterranean.

A l'aide d'images Landsat, on a pu identifier dans le bassin méditerranéen des linéaments de l'écorce terrestre. Leur longueur, leur forme et leur orientation ont été analysées et suggèrent la possibilité d'identifier le caractère génétique de la plupart des linéaments: tension, compression, ou le frottement. L'orientation des linéaments, aussi bien que leur caractère génétique, soutiennent fortement le concept d'un large affaissement de l'écorce terrestre dans le bassin méditerranéen.

Introduction: At the December 1974 meetins of the C.I.E.S.M. in Monaco Foose (1974) suggested that lineament data from Landsat images might be classified according to length and shape, threby providing the basis for interpreting the genetic character of the lineaments. Short straight lineaments would be cause by normal faults or prominent joint sets (tension). Longer, wavy-shaped lineaments would be created by erosion of the upper plate of thrust faults or of gravitationally detached crustal blocks (compression). Much longer, straight lineaments would be crustal shear.

This paper presents some results of the research since 1974 on analytical techniques for lineament observation, analysis, and interpretation.

Analytical Methods: Lineament data must be studied and interpreted only within discrete morphotectonic provinces (crustal units having a similar tectonic evolution - i.e. the Tyrrhenian Basin). Three fundamental parameters of all lineaments have been observed and recorded: length, shape, and azimuth.

1. Lineament length: Based on studies by Foose and Brigham (1977), thousands of measurements have shown that the surface expression on Landsat images of prominent joint sets and normal faults produces lineaments with short strike lengths, less than 12 km. Almost all low angle reverse or overthrust faults (including gravitational glide masses) have long strike lengths, greater than 12 km. All strike-slip faults have strike lengths greatly exceeding 12 km.

2. Lineament Shape: Most straight lineaments are created by joint sets, normal faults, or strike-slip faults; wavy lineaments by thrust

(gravitational glide) faults.

3. Lineament Azimuth: The azimuth data for all lineaments are grouped into 5-degree wide segments covering the 180-degree arc extending from East to West.

Using the five parameters described above (short and long lineaments, straight and wavy lineaments, and lineament azimuth, three methods of plotting data have been employed: Frequency vs. Length histograms; Frequency vs. Azimuth histograms; Density (total lineament km.) vs. Azimuth histograms. Four important facts have emerged from the analysis of these histograms from all morphotectonic units in the Mediterranean Basin. First, the mean kilometer length for straight lineaments is consistently and significantly smaller than for wavy lineaments in each morphotectonic unit. Second, straight lineaments are always in the majority. Third, the great majority of straight lineaments in all morphotectonic units are shorter than 12 km. Finally, as the mean lineament length for both total lineaments and wavy lineaments increases, the incidence of thrust faults (gravity glide) or strike-slip faults, or both, increases within that morphotectonic unit.

Lineament Analysis: Analysis of the lineaments within a morphotectonic unit involves determination of: 1. the azimuth of each preferred orientation and the width of the azimuth interval within which it lies; 2. the relative percentage within each interval of the four lineament types (LW = long wavy; SW = short wavy; LS = long straight; SS = short straight). As an example of the method, all of the lineament data from western Italy, Sicily, Sardinia, and Corsica have been combined in the following table:

Lineament Analysis of Tyrrhenian Basin
(Total Lineament Kilometers: 14,210)

Preferred Orientation	Degrees Width Azimuth Interval	Lineament Type LW	SW	LS	SS	Percent of Total
N88W	15	14	36	12	38	13.0
N55E	20	21	23	7	49	15.0
N60W	20	6	34	11	49	12.4
N12W	15	21	23	6	50	6.5

These data show: 1. Short lineaments are in much greater abundance than long. 2. Straight lineaments are more abundant than wavy. The obvious conclusions are that normal faults with relatively short strike length are the dominant structures around the entire basin and that tensional conditions prevailed in the crust when they were formed. The four major tectonic orientations indicates that the Tyrrhenian Basin is a centrally stressed tectonic system with more or less equal distribution of strike directions of its structural features. Radial and peripheral tensional faults within and around the edge of the Tyrrhenian Basin have produced crustal blocks with varying amounts of subsidence. Analysis of data for the Aegean Basin reveals a similar tectonic framework.

The methods of lineament analysis described above provide a powerful tool for regional tectonic studies.

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