

## FIELD OBSERVATIONS AND SOME TECTONIC ASPECTS OF BANAVI-AREA, AMADIA, NORTHERN IRAQ (\*)

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(5 fig. dans le texte)

### RÉSUMÉ

L'anticlinal d'Ora est essentiellement constitué de roches paléozoïques et mésozoïques. Il est de style alpin, caractérisé par des écailles tectoniques et des charriages.

Le déplacement du géosynclinal nord de l'Irak, du NW vers l'E dans la partie SE du pays, vers l'W dans sa partie N, s'est effectué au pré-Jurassique.

### ABSTRACT

The Ora anticline consists mainly of Paleozoic and Mesozoic rocks. The tectonic style in the area is of Alpinotype, characterised by Schuppen-tectonic and thrusting.

The shifting of the northern geosyncline of Iraq from NW in the southeastern sector of the country to east-west in its northwestern sector is Jurassic in time.

### INTRODUCTION

The present paper contributes to the geology of Banavi Area, approximate 100 Km. North of Mosul. Latitude 43 21' — 43 25', longitude 37 14' — 37 16' (Fig. 1).

The most spectacular structural feature in the study of the area is the Ora anticline, striking E-W and points with its steeper limb towards south.

The eastern part of the Ora anticline lies beyond the Iraqi-Turkish border and is nearly 2400 m in altitude.

The results of detailed structural analysis are discussed in relation to the geosynclinal classification as well as the evolution of the shifting of the northern geosyncline of Iraq from NW in the southeastern part of the country to east-west in the northwestern part (Fig. 1).

### I. STRATIGRAPHY

In its core the E-W asymmetrical Ora-anticline exposes the Khabour Quartzite, which is the oldest known formation in Iraq (Wetzels, 1950, and Seilacher, 1961).

The paper describes these Formations, which reveal new field diagnostic features.

#### 1. *Paleozoic.*

It is characterised by two transgressions and by shallow water deposits ranging from clastic to chemical and organogenic sediments. Clastic material prevails in the

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early Paleozoic and the beginning of late Paleozoic, whereas the organogenic limestone predominates in late Paleozoic.

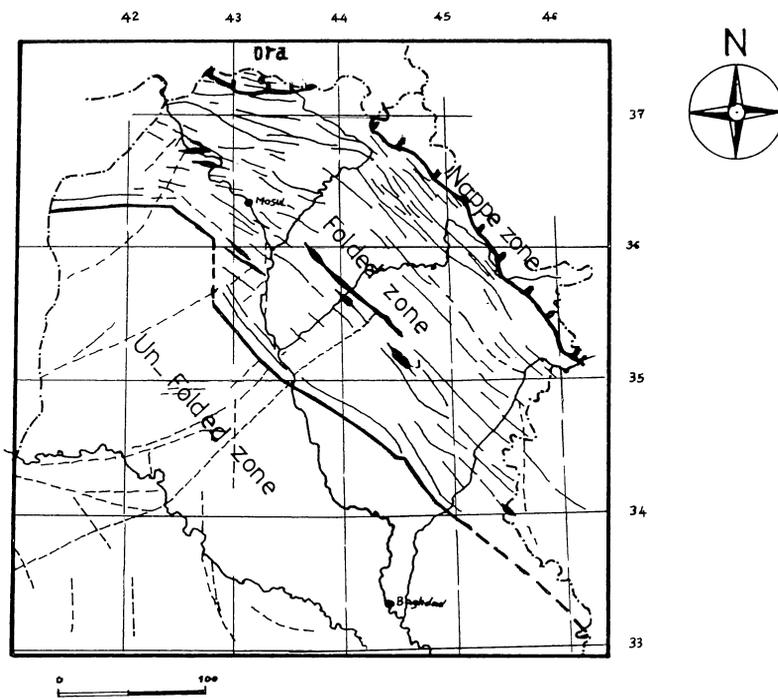


Fig. 1. — Location map.

In ascending order the following rock-units have been observed (Fig. 2).

*Khabour Quartzite* (Ordovician, after LEX. Strat. Intern.).

The age of this formation is controversial. DUNNINGTON (1958, P. 1198) suggested a Cambro-Ordovician age, whereas WETZEL (1950) and SEILACHER (1963) regarded it as belonging to the Ordovician. Petrographic study of Khabour Quartzite was presented by PHILLIP (1957) and SCHUAIB (1969), who interpreted its genesis in two different ways.

*Pirispiki Red Beds* (Devonian, SEILACHER, 1963).

The formation is composed of alternation of fine grained sandstones, quartzites and shales. It is subdivided here into two units namely :

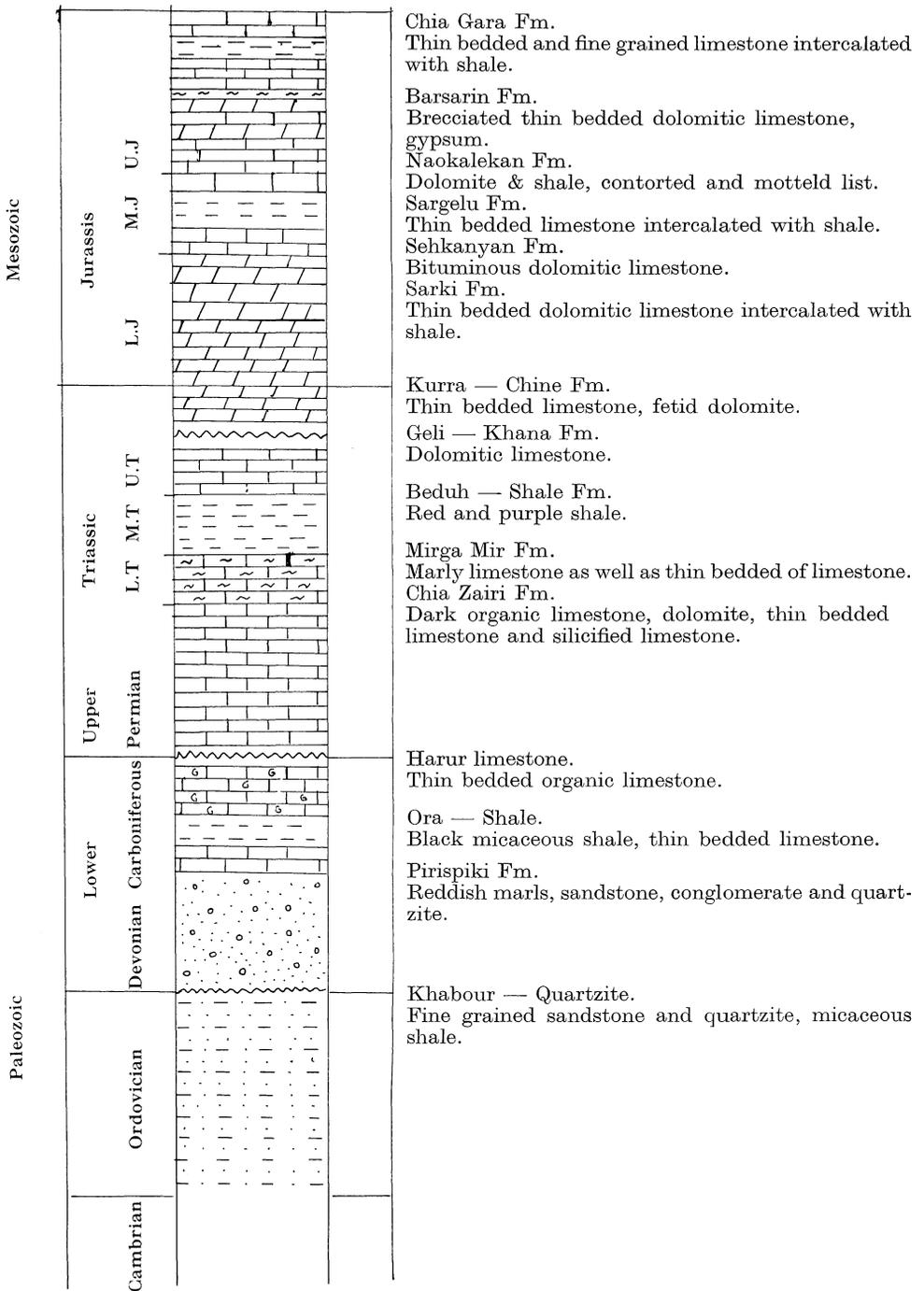
*Upper part* is comprised of white, fine grained, massive and thick bedded (thickness of a bed about 3 m) quartzite alternating with grey shales.

*Lower part* is built up of reddish brown, fine grained, hard and massive sandstones alternating with red shales.

## 2. Mesozoic.

The prevailing sediments are mainly chemical, the clastics play only a negligible role.

Color may be diagnostic for the different periods of the Mesozoic.



The Lower Triassic is characterized by typical yellowish color, whereas Middle and Upper Triassic is composed of thick, grey dolomite limestone beds. Dark colors prevail generally in the Jurassic formations.

*Geli Khana Formation* (M. Triassic, Lex. Strat. Int.).

This formation could be subdivided here into two units according to the thickness and sedimentary structure of the beds.

1. The *Upper Unit* is formed of mainly thickbedded (thickness of the individual bed is about one meter) dark dolomitic limestone intercalated with black shales.

2. The *Lower Unit* is built up of greyish to yellowish limestone. Synsedimentary structures « Melikerian Structure » is diagnostic for the upper unit of the Geli Khana Formation.

*Jurassic Group.*

As mentioned before, this group is generally characterized by dark colors, and the rocks are commonly dolomitic limestones.

*Sarki Formation* (L. Liassic, Lex. Strat. Int.).

The formation consists of thin bedded dolomitic limestones (thickness of an individual bed is about 20 cm), dolomite and oolitic limestones intercalated with shales.

The upper part of the formation is made up of relatively thicker beds. At Hadiena Village the uppermost part of this formation is built up of alternating grey limestones with brown, thin-bedded saccharoidal dolomitic limestone, which represents the first sign of Sehkanian Formation.

*Sehkanian Formation* (U. Liassic).

This formation is commonly recognized by dark colors and by the coarse-grained texture of its forming dolomitic limestone.

It is here subdivided into three units :

1. The Upper Part is a dark, thick-bedded dolomitic limestone. Occurrence of synsedimentary folds are not uncommon (Fig. 3).

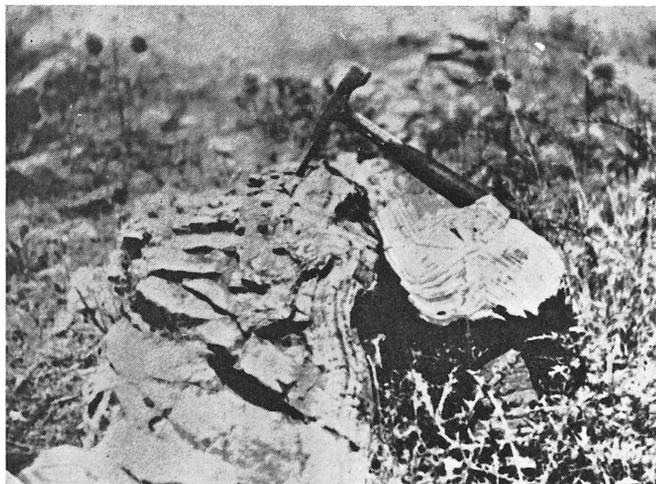


Fig. 3. — Synsedimentary structures (folds) in the upper part of Sehkanian Formation, 400 m SW Hadiena.

2. The Middle Part consists of thin-bedded bituminous dolomitic limestone interbedded with thick-bedded dolomitic limestone. Fossils and plant debris are abundant in this unit. This unit may be recognized in the field by a black soil formed as weathering product of its bituminous beds.

3. The Lower Part is dark, thick-bedded, sacharoidal fetid dolomitic limestone and dolomite. Brecciated dolomitic limestone occurs 400 m SW of Hadiena where the brecciated fragments are about 10 cm in diameter cemented by a dark dolomitic limestone (Fig. 4).



Fig. 4. — Brecciated dolomitic limestone SW of Hadiena.

## II. SEDIMENTS AND TECTONICS

The sediments which prevailed in early Paleozoic time and at the beginning of the late Paleozoic period are elastics, mainly shales, sandstones and quartzites, whereas the late Paleozoic deposits are mainly characterized by organogenic and chemical sediments. More than 2 km of sediments were deposited during Paleozoic on relatively shallow shelving floor.

The extensive development of Precarboniferous clastic beds suggests that rivers flowed from emergent land. In Precarboniferous time the land generally has been peneplaned, and conditions were propitious for carbonate deposits during the Carboniferous.

The Paleozoic era is probably imparted with major unconformities :

The first unconformity is between the Khabour Quartzite (Ordovician) and the Pirispiki Red beds (Devonian?), which might be reflected by current changes from NE in Ordovician to NW in Devonian (SEILACHER, 1963). Such a stratigraphical gap of smaller dimension was manifested in Taurides (WOLFART, 1967, P. 173).

The Silurian most probably occurs as clastic material within the Khabour Quartzite (Ordovician) (cf. KLEMME, 1958, P. 488-490).

The second unconformity took place between the Harur Limestone (Lower Carboniferous) and the Chia Zairi Limestone (Upper Permian). In other words the break in sedimentation in the first case took place in clastic sediments and is equi-

valent in time to the Caledonian orogeny (Taconian — diastrophism) in Europe (SEILACHER, 1963), whereas in the second case the break occurs in carbonate sediments and corresponds to the Hercynian orogeny in Europe. The Paleozoic in Iraq is characterized by a shelf-facies and mild tectonism. The occurrence of subaqueous slumpstructures in Upper Geli Khana Formation (M. Triassic) is considered as an indication for subsequent epeirogenic movements, which had taken place at the close of middle Triassic.

The fold tectonic of Ora shows southward inclination. The axis of the anticline predominantly trends E-W is shifting (warping) to NW nearly to Ora Village. The fault tectonic with faults in ac-direction and the thrust fault in the bc-direction are probably younger than the fold tectonic, and the bc-fault is older than the ac-fault (Fig. 5). The main trends of the faults are E-W, or approximately N-S, and sometimes NW-SE.

The faults are concentrated in the area south of Banavi. The valleys display the same pattern-trend as the faults.

A major E-W trending fault is traced by Wadi Bista Ora (1.75 km north of Banavi) which becomes nearly N-S parallel to ac-plane. This N-S fault is responsible for the shifting in the axis of the Ora anticline.

E-W thrusting and Schuppen-tectonic are seen in the Banavi area, where sediments of Mesozoic and Tertiary are brought in juxtaposition. The thrusting is accompanied with repetition and omission of some formations and is directed from north to south (Fig. 5). Regionally the extreme northern part (or the so called thrust zone of northern Iraq « part of Taurides ») forms a narrow belt of mountains with an average width of 9 km, which is partially comparable with the thrust zone NE of Iraq (Bolton, 1956). The Banavi area could be considered apparently as a part of miogeocyncline and according to Stille, 1936 and Kay, 1945a the thrusting and Schuppen tectonic are typical for miogeosyncline. After Schwab (1971, P. 929) the miogeosyncline include thin, blanket orthoquartzite viz., the Khabour Quartzite.

It might be possible that the thrust fault was an old tectonic element which had been rejuvenated under stress : in other words, it is a persistent zone of crustal weakness, which marked the boundary between the thrust zone (miogeosyncline) and the folded zone. The folded zone also is best regarded as a parageosyncline which has risen from block-faulting in the basement (Al-Rawi, 1973), and according to the above mentioned conclusion, a similar result of the parageosynclinal character of the folded zone is gained by Buday (1970).

The possibility of decollement in forming the folded zone seems to be improbable, because cross-sections also revealed no presence of box fold.

The continuation of the thrust fault (lineament) with E-W direction is curved and shifted towards NW at its extreme west approach. The nearly lying anticlinal structures of the folded zone to this lineament display the same phenomenon as they are probably genetically related (cf. Fig. 1).

However, the indication of rotational faulting was not found in the field, where the cross section of the fault surface appears as a segment of a circle concave upwards. A pre-existence of the shifting of the northern geosyncline from NW in the SE part to E-W in the NW part of Iraq is assumed in Liassic sediments (Dunnington, 1958, p. 1200) and might be controlled by E-W trending fault.

The shifting of the northern geocyncline as a tectonic phenomenon is discussed in a recent paper by the author.

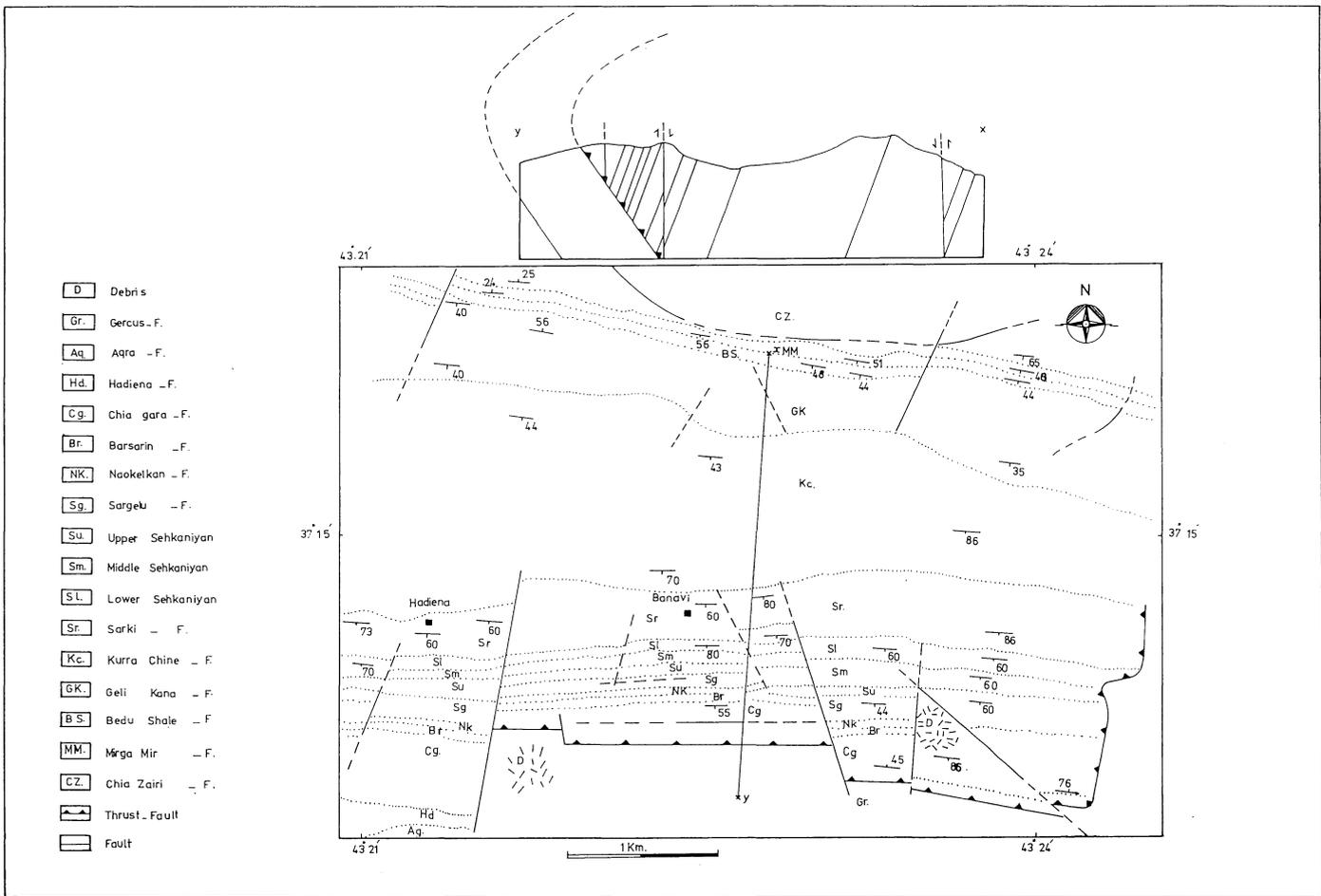


Fig. 5. — Geological map of the investigated area.

## CONCLUSION

The northern thrust zone of Iraq is apparently a part of miogeocyncline. The thrusting is directed from north to south. The Paleozoic sediments reveal two cycles of deposits :

The first cycle (Ordovician — Devonian) : The sediments are mainly clastics (shales, sandstones and quartzites) when the Silurian is missing due to compensation movements which are equivalent to Caledonian orogeny.

The second cycle of the deposits is characterised in late Paleozoic mainly by organogenic and chemical sediments.

The Upper Carboniferous deposits are missing in the area. The Upper Permian sediments lying unconformably on the Harur limestone (L. carboniferous). Similar results in Taurides were gained by Buggisch (1973).

Finally the Paleozoic in Iraq is characterised by mild tectonism and shelf sediments deposited in an underfed geosyncline.

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