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BIOSTRATIGRAPHY OF THE ANAH AND EUPHRATES FORMATIONS AT WADI BANAT AL—HASSAN (W. IRAQ)

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ABSTRACT

The purpose of this study is to elucidate the microfacies and the biozones present in the studied rocks as well as to determine their environments of deposition.

The study depends mainly on the benthonic foraminiferal assemblages identified from (27) rock thin sections made available from an outcrop at Wadi Banat Al-Hassan area in the Upper Euphrates Valley.

X—Ray defraction was also used to determine the type of carbonate minerals present in the studied rocks.

INTRODUCTION

During a field excursion at Wadi Banat Al-Hassan attention was drawn on some facts concerning the several systems of joints found on the surface of the Euphrates Formation, the ubiquitous pot holes in the coarse of the valley, the presence of collapse sinks, caves and other features of karstification and the marked difference in the shrubs flora that grow on each of the two formation. The study of the biostratigraphy and microfacies aims to elucidate some of these phenomena.

Location : Wadi Banat Al—Hassan drains into the Euphrates River and Joints it on its right bank at about (110) km. from the center of Anbar district, (i.e. Ramadi City). The studied outcrop section is located at 42° 25, E and 33° 59, 30,, N. (Fig. 1).

The oldest exposed rocks near the axis of the wadi belongs to Anah Limestone Formation; the thickness of these rocks is (5) meters. A layer of richly fossiliferous limestone, basal conglomerates overlies Anah Limastone disconformably. The overlying sediments of the Euphrates Formation covers most of the area around the wadi; the thickness of Euphrates Limestone

including the basal conglomerates is about (19) m. Recent and Holocene sediments cover the Euphrates Limestone, with exception of few scattered layers of alternating marl and gypsum which indicate "Lower Fars Formation"

Van Bellen (1956) was among the first workers who studied the type section of the Anah Limestone near Anah, later studies spread to include outcrop sections at Qara Chauq structure, Wadi Fuhaimi, Zakho and Wadi Khazaga (W. Desert). and some subsurface sections. Besides Van Bellens (1959) description of its type section; further surface and subsurface sections were studied, namely Wadi Haglan, Anah and Wadi Baghdadi in addition to many surface and subsurface sections in west and centfal Iraq.

This study was aided by the following published and unpublished works, some about Iraq and some about other parts of the world : Henson (1950); Bozorgnia & Banafti (1964); Johnson (1964a, b), Cole (1965); James & Wynd (1965); Philip and Youish (1966); Al-Khersan (1968); Sampo (1969); Ctyrocky & Karim (1971); Al-Saddiqi (1970) (1972); Karim & Ibrahim (1974); Edgell & Bassoni (1975); Mehrnush & Partoazar (1977); Karim (1975) (1978); Abid (1983); A., Al-Hashimi & Amer (1985); Al-Ghreri (1985) and Jamil & Al-Jassim (1986).

The present study is to supplement and not supplant the previous ones; it fills the gaps and facilitate better correlation.

BIOSTRATIGRAPHY

1. ANAH LIMESTONE FORMATION :

It is evident from the field description and microcopic studies of thin sections, that the outcropping part of this unit is made up of recrystallized massive reefal limestone. The following fossils were identified this section : *Austrotrillina howchini* Schlumberger *Austrotrillina asmariensis* Adamsi *cnias, kirkukensis* Henson; *Sorites orbiculus* (Forskal); *Marginopora* sp.; *Borelis pygmaea* Hanzawa; *Dendritina rangi* d'orbigny; *Amphistegina* sp.; *Peneroplis evolutu* Henson; *Peneroplis thomasi* Henson; *Peneroplis Peneroplis* (Fichtel & Moll); *Prarhapydionina delicata* Henson; *Meandropsina anahensis* Henson; *Spirolina austriaca* d' Orbigny; *Bolivina* sp.; Miliolids; *Lithophyllpm* sp.; *Mesophyllum* P.; *Lithothamnium* sp.; *Subterranophyllum thomasi* Elliott; Coral (*Actinacis* 3); gastropods; pelecypods; ostracods and echinoids (Fig. 2).

2. EUPHRATES LIMESTONE FORMATION:

Using the same methods mentioned above in the study of the underlying Anah Formation, the Euphrates Formation, consist of a basal conglomerate layer which is overlain by well stratified dolomitized limestone, which may alternate with dolomite. The uppermost part of the unit is dolomitic. The below listed microfossils were identified from the studied section :

Austrotrillina howchini Schlumberger; *Austrotrillina asmmariensis* Adams; *Archias operculiniformis* Henson; *Archaias kirkukensis* Henson; *Marginopora* sp.; *Sorrites orbiculus* (Forskal); *Borelis pygmaea* Hanzawa; *Dendritina rangi* d'Orbigny; *Amphistegina* sp.; *Peneroplis evolutus* Henson; *Peneroplis thomasi* Henson; *Peneroplis planatus* (Fichtel & Moll); *Peneroplis farsensis* Henson; *Praerhapydionina delicata* Henson; *Nummulites fichteli* Michelotti; *Henterostegina assilinoides* Blankenhorn; *Operculina compalanata* Defrance; *Bolivina* sp.; *Meandropsina anahensis* Henson; *Meandropsina iranica* Henson; *Spirolina austriaca* d'Orbigny; *Ammonia beccarii* Linne; *Borelis melo melo* (Fichtel & Moll); *Borelis melo* (Fichtel & Moll) var *curdica* Reichel; *Peneroplis* sp.; *Rotalia umbonata LeRoy; Miliolids;*

Chilostomellinids; *Lithophyllum* sp.; *Mesophyllum* sp.; *Clypeina* ep.; gostropods, pelecypods, ostracords, echinoids; Bryozoa (*Tubucellaria* sp.) and *Corallaria* cf. *biotithic* (Fgi. 2).

X—Ray diffractograms of selected carbonate powder samples are shown in Figure (3).

MICROFACIES

The following microfacies has been identified from the rocks of the two formations (the Anah and the Euphrates) into the following sub-microfacies, based on Dunham's (1962) classification (as modified by Embry and Klovan, (1972) :

1. Miliolid packstone subfacies
2. Coral boundstone subfacies
3. Peneroplid packstone subfacies
4. Mudstone subfacies
5. Peloidal grainstone subfacies
6. Peneroplid wackstone subfacies

The vertical distribution of these subfacies of the two rock units is illustrate on Figure (2), excluding the basal conglomerate layer.

If any conclusion is to be drawn regarding the environment of deposition, it may be possible to say that the microfacies of the Anah Formation suggest shallow, warm environment with low to moderate energy level; while those facies of the Euphrates indicate coastal lagoons orsemi-isolatedand confined inner shelf conditions.

BIO — ZONATION

Utilizing only the most prominent benthonic foraminiferal assembleges identified within the rocks of Anah Formation it was possible to identify a *Miogypsinoides* zone Van Bellen (1956) suggested that the range of such zone is Late Oligocene-Early "Lower" Miocene. Since the outcrops of Anah Formation in this location represents only the upper of the unit; it is evident that the range of this subzone does not coincide with what Van Bellen had suggested in the Kirkuk area. Within the Euphrates Formation, it is possible to delineate to delineate the following two biozones :

a) An older *Ammonia beccarii* assemblage zone : The appearance of this species in matrix of the basal conglomerate layer is indicative of in situ sedimentation i. e. the start of marine invasion anti-dating the short duration of exposure and erosion of the Ansh Formation sometime in the early Miocene. This zone is partly associated with reworked fauna of the Anah and older formations and partly associated with younger assemblages of the Euphrates Limestone.

b) A younger *Borelis melo curdica-Ammonia beccarii* assemblage zone : It includes most of the thickness of the exposed Euphrates Limestone in this section (Fig. 2).

CONCLUSIONS

The results of this study does not alter greatly the picture drawn by previous studies regarding microfacies, and biostratigraphy, of the Anah and the Euphrates Formations, on the contrary it supplements the previously drawn conclusions. However some additional notes can be drawn from the study of the present section. The microfaunal list expanded to include the presence of *Marginopora, Dorites orbiculus* and *Austrotrillina asmariensis* the presence of the latter species in Iraq should be investigated further using more solid and thin section materials. The absence of the charaphytes and calcispheres which is reported in the type area by Abid (1983) may indicate a slight shift to the deeper waters.

The almost pure cakitic nature of the Anah Formation and the dolomitic. fructured and jointed Euphrates Formation added to the contimnous influx of water in the direction of the Euphrates River are ideal requirements for the karstification in the area, the more shallow the Anah Formation is, the more is the chance for its solution and the appearance of cavities. The ecological contrast between the two units should be further investigated in nearby sections.

The faunal association of the conglomerate layers should be fully investigated; mixing of Eocene-Oligocene-Miocene fauna may be of a great value in paleogeographic and paleogeologic interpretations of the general setting of the studied and the neighbouring area.

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PLATE 1

1. Wackstone with *Borelis melo melo melo* (Fichtel & Moll); Euphrates Limestone Formation; sample 17, ×40.
2. Wackstone with *Borelis melo* (Fichtel & Moll) var. *curdics* Reichel; Euphrates Limestone Formation; sample 14, ×40.
3. Packstone with *Peneroplis farsnsis* Henson; Euphrates Limestone Formation; sample 11, ×30.
4. Mudstone with *Dendritina rangi* d'Orbigny, Euphrates Limestone Formation,, sample 13, ×40.
5. Packstone With *Marginopora* sp.; Anah Limestone Formation; sample 7; ×25.
6. Wackstone with *Ammonia beccarii* Linne and Miliolids; Euphrates Limestone Formation sample 16, ×35.
7. Packstone with *Archaias kirkukensis* Henson; Anah Limestone Formation; sample 6; ×25.
3. *Archaias operculiniformis* Henson (Basal conglomerates); Euphrates Limestone Formation; sample 9, ×35.

PLATE 2

1. Peloidal grainstone with *Meandropsina anahensis* Henson.; Euphrates **Limestone Formation; sample 15; X30.**

2. Wackstone with Me*andropsina Iranica* Henson; Euphrates Limestone **Formation; sample 14; X30.**

3. Packstone with *Borelis pygmaea* Hanzawa; Anah Limestone Formation; **sample 6; X40.**

7. Packstone with *Peneroplis evolutus* Henson; Anah Limestone Formation; **sample 6; X40.**

5. Packstone with *Peneroplis thomosi* Henson and *Austrillina howchini* **Schlumberger; Anah Limestone Formation; sample 6; X30.**

6. Packstone with *Sorites orbiculus* (Forskal); Anah Limestone Formation; **sample 6; X30.**

7. Packstone with *Peneroblis planatus* (Fichtel & Moll); Anah Limestone **Formation; sample 2; X40.**

8. Packstone with *Austrotrillina asmariensis* Adams; Anah Limestone **Formation; Sample 7; X40.**

PLATE 3

1. *Nummulites fichteli* Michelotti (Basal Conglomerates); Euphrates Limestone Formation; sample 10; X16.
2. *Heterostegina assilinoides* Blankenhorn (Basal Conglomerates); Euphrates Limestone Formation; sample 10; X30.
3. *Operculina compalanata* Defrance (Basal Conglomerates); Euphrates Limestone Formation; sample 10; X30.
4. Packstone with *Praerhapydionina delicata* Henson; Anah Limestone Formation; sample 2; X35.
5. Packstone with *Amphistegina* sp.; Anah Limestone Formation; sample 6; X30.
6. Wackstone with *Peneroplis* sp;. Euphrates Limestone Formation; sample 21; X35.
7. *Corallaria* cf. *biotithic* (Basal Conglomerates); Euphrates Limestone Formation; sample 9; X40.
8. Boundstone with Coral (*Actinacis* sp.); Anah Limestone Formation; sample 4; X30.

PLATE 4

1. *Spirolina austriaca* d'Orbigny (Basal Conglomerates); Euphrates Limestone Formation; sample 9; X35.
2. Packstone with *Bolivina* sp., Anah Limestone Formation; sample 6; X40.
3. Wackstone with *Rotalia umbonata* LeRoy; Euphrates Limestone Formation; sample 14; X30.
4. Wackstone with Chilostomellinids; Euphrates Limestone Formation; sample 17; X35.
5. Packstone with echinoids fragment; Anah Limestone Formation; sample 2; X25.
6. Peloidal grainstone with pelecypod; Euphrates Limestone Formation; sample 15; X25.
7. Dackstone with Bryozoa (*Tubucellaria* sp.); Euphrates Limestone Formation; sample 14; X35.

Biostratigraphy of the Anah and Euphrates

PLATE 5

1. **Wackstone with gastropod; Euphrates Limestone Formation; sample 14; X30.**
2. **Wackstone with ostracod; Euphrates Limestone Formation; sample 17; X30.**
3. Packstone with *Subterranophyllum thomasi* Elliott; Anah Limestone Formation; sample 2; X35.
4. Packstone with *Mesophyllum* sp.; Anah Limestone Formation; sample 7; **X30.**
5. Packstone with *Lithophyllum* sp.; Anah Limestone Formation; sample 1; **X30.**
6. Packstone with *Lithothamnium* sp.; Anah Limestone Formation; sample 6; X30.
7. Peloidal grainstone with *Clypeina* sp.; Euphrates Limestone Formation; sample 15; X30.

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التطبق الحياتي لتكويني عنه والفرات في وادي بنات الحسن
(غرب العراق)

عبدالله شاكر السياب و اشواق طالب الحمداني
قسم علم الأرض ـ كلية العلوم ـ جامعة بغداد ـ بغداد

الخلاصة

ان هدف هذه الدراسة هو القاء الضوء على السحنات الدقيقة والأنطقة الحياتية الموجودة في الصخور المدروسة اضافة الى تحديد بيئاتها الترسيبية .

اعتمدت الدراسة بصورة اساسية على تجمعات الفورامينيفيرا القاعية التى تم تمييزها من سبع وعشرين نموذج صخري من مكاشف وادي بنات الحسن في وادي الفرات الأعلى .

ولقد استخدمت طريقة حيود الأشعة السينية أيضاً لتمييز أنواع معادن الكاربونات الموجودة في الصخور المدروسة .

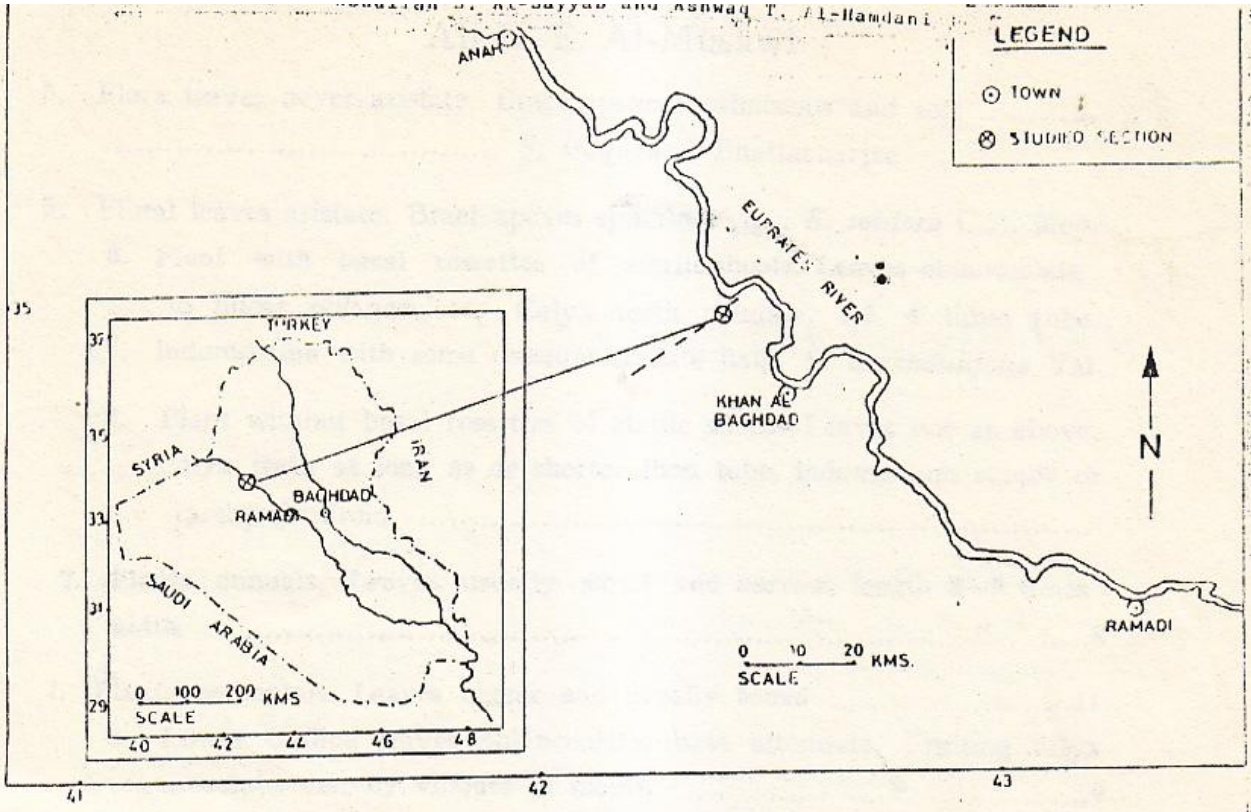


FIGURE 1. LOCATION OF THE STUDIED AREA

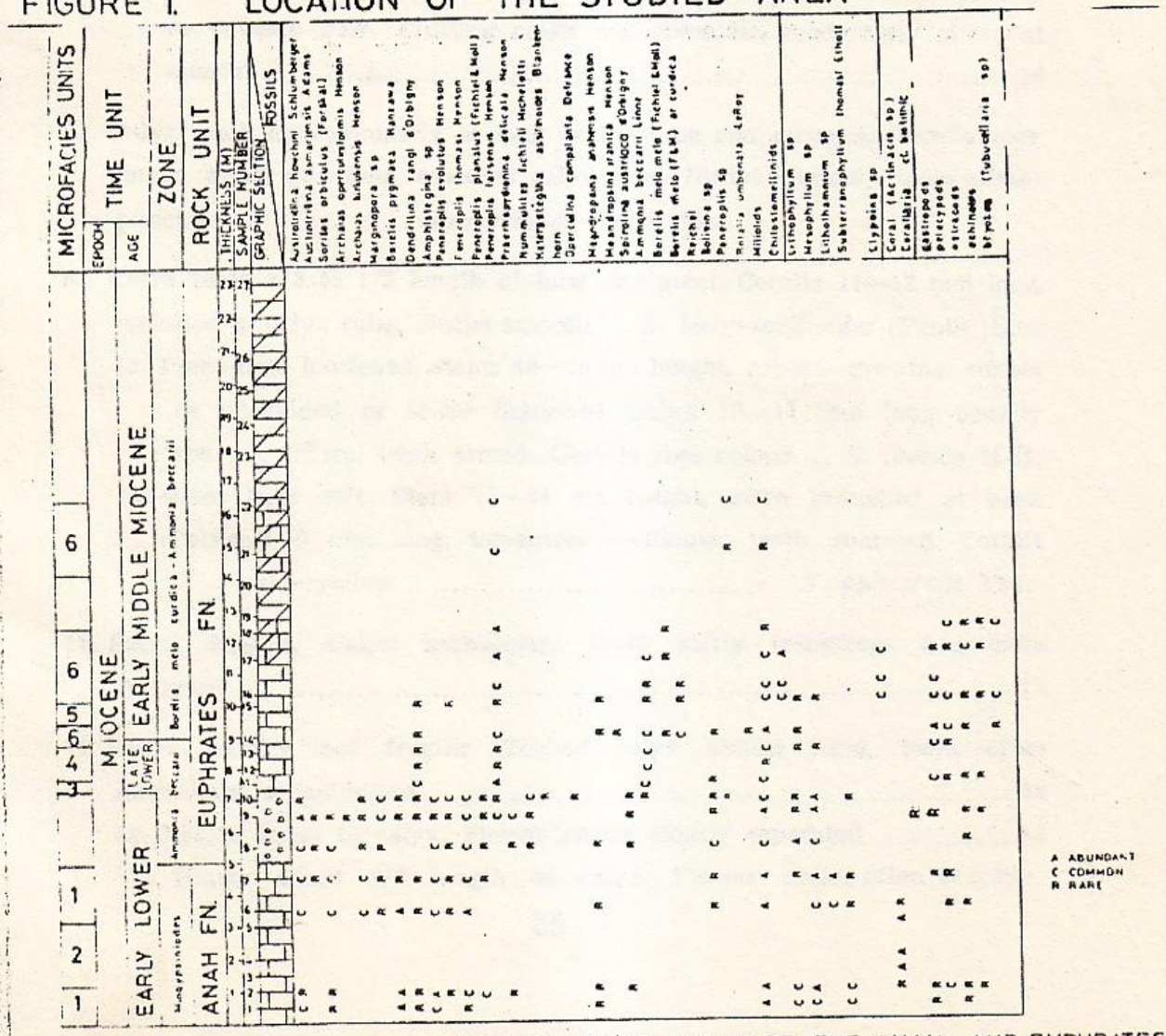
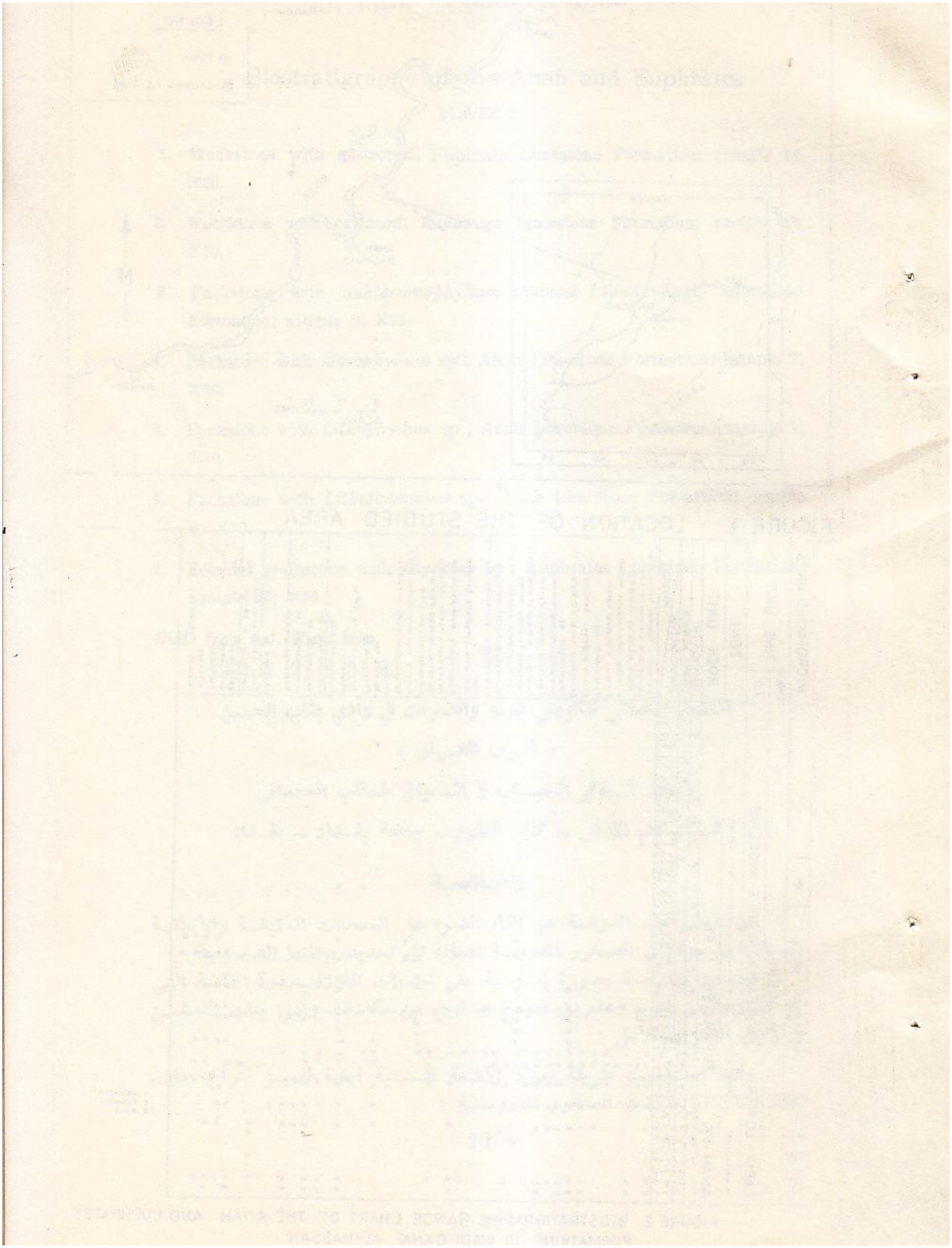


FIGURE 2. BIOSTRATIGRAPHIC RANGE CHART OF THE ANAH AND EUPHRATES FORMATIONS IN WADI BANAT AL-HASSAN



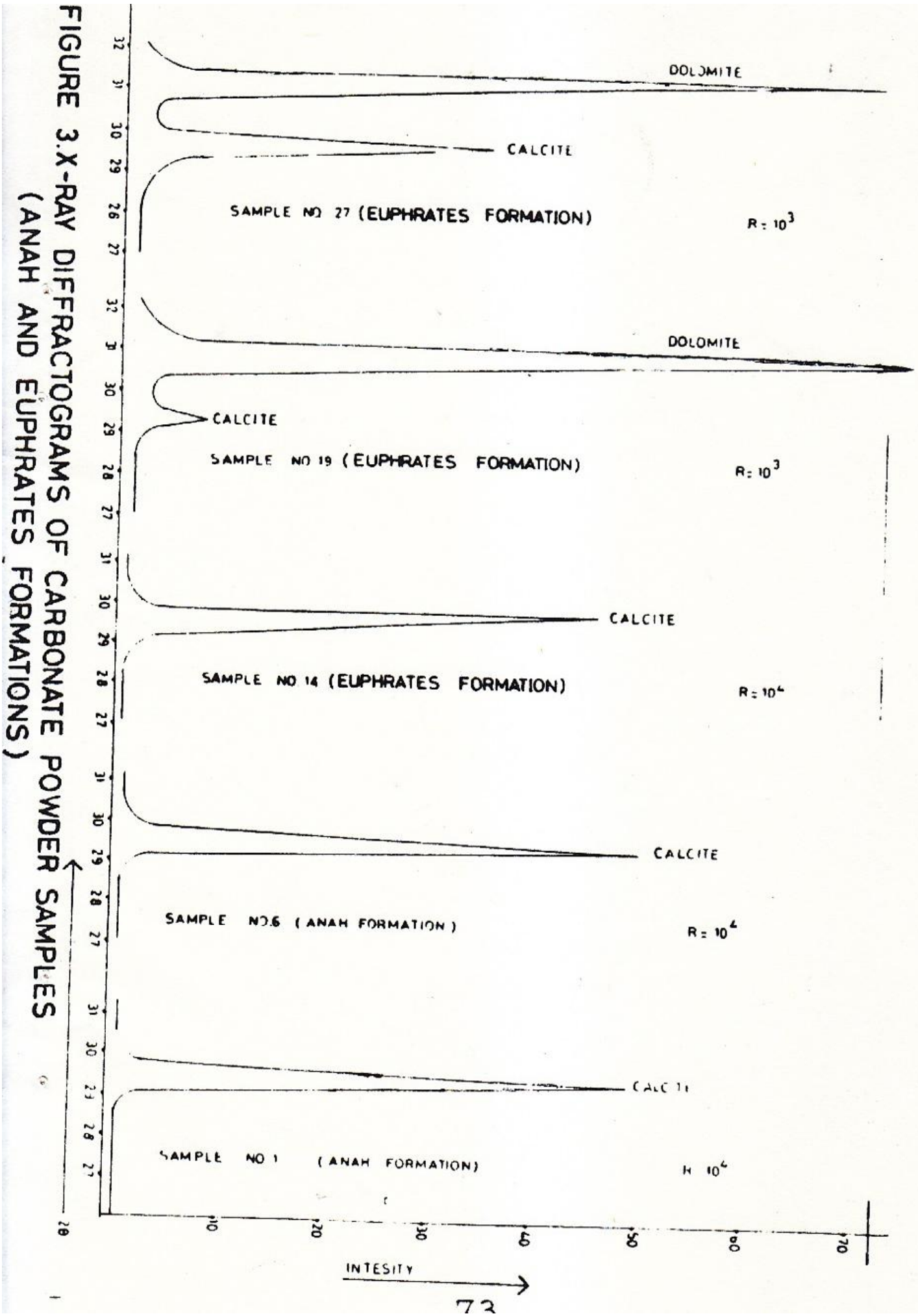


FIGURE 3.X-RAY DIFFRACTOGRAMS OF CARBONATE POWDER SAMPLES (ANAH AND EUPHRATES FORMATIONS)

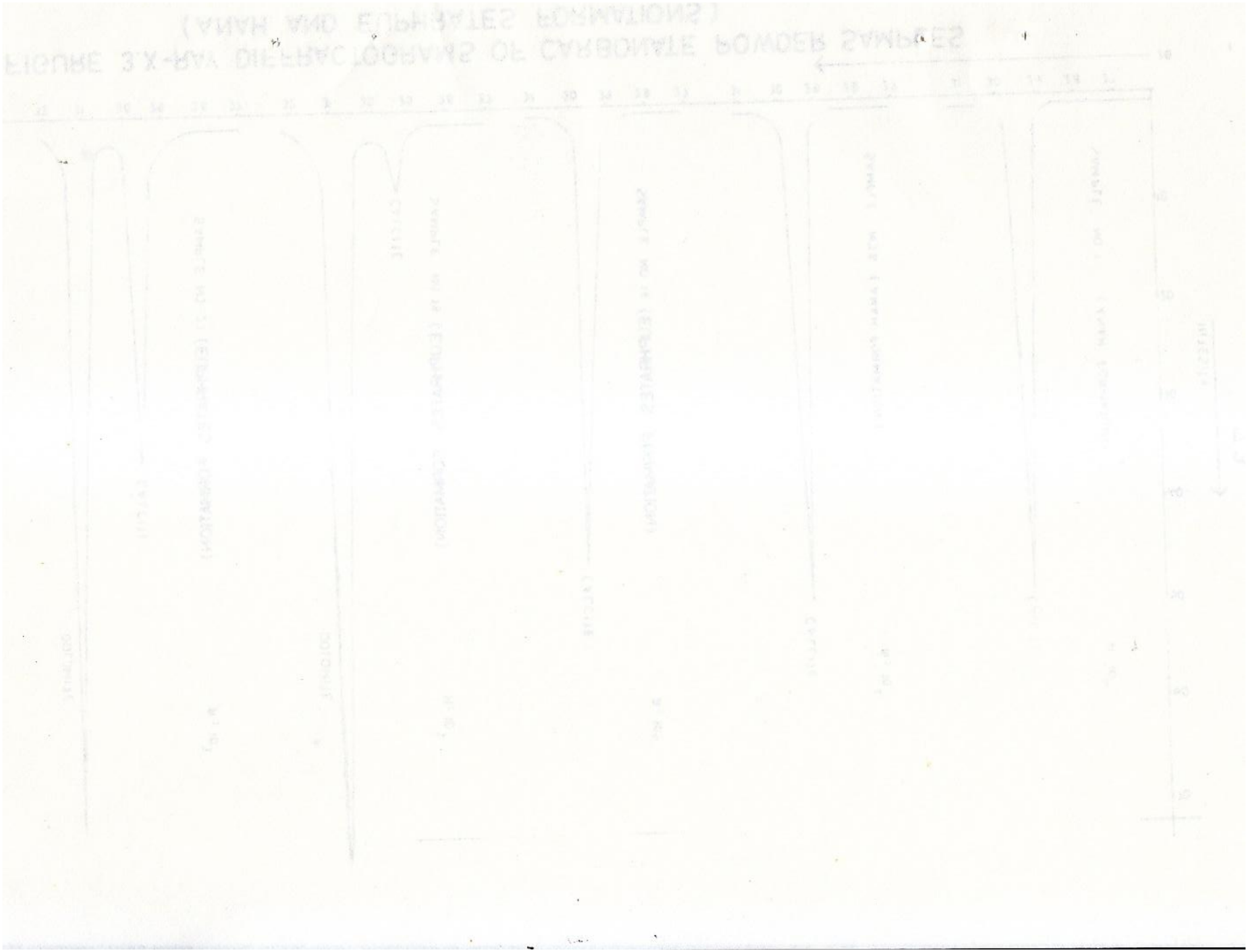
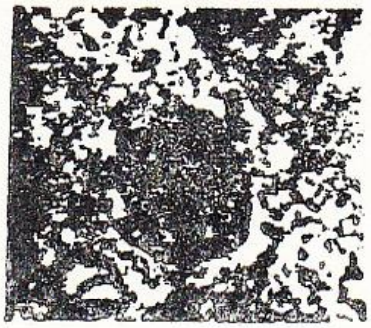


PLATE -1-



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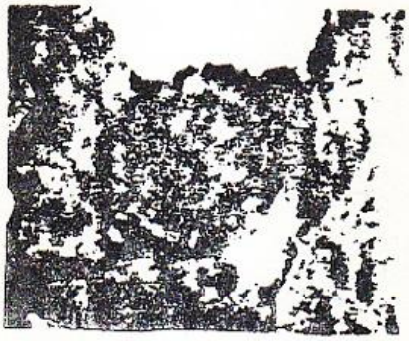

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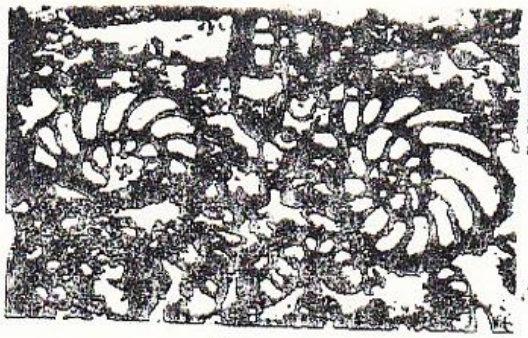

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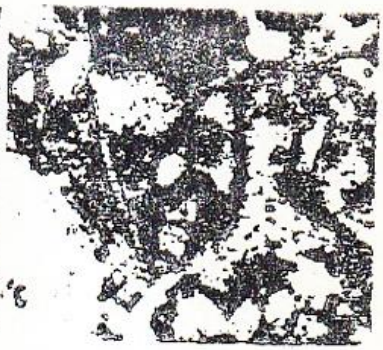

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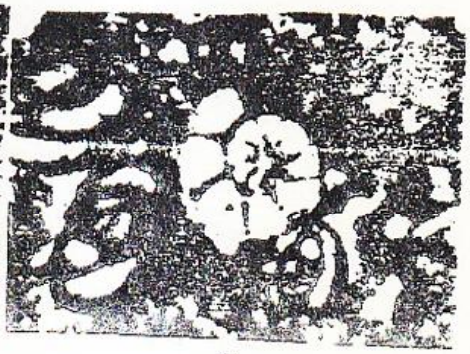

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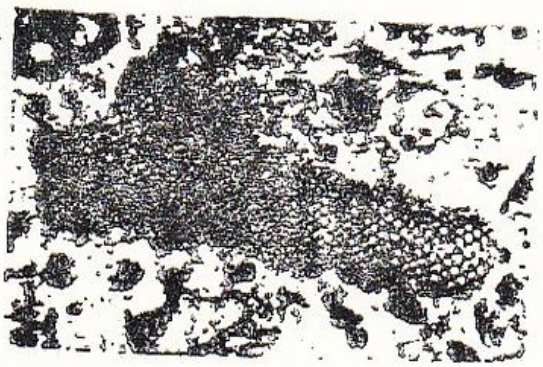

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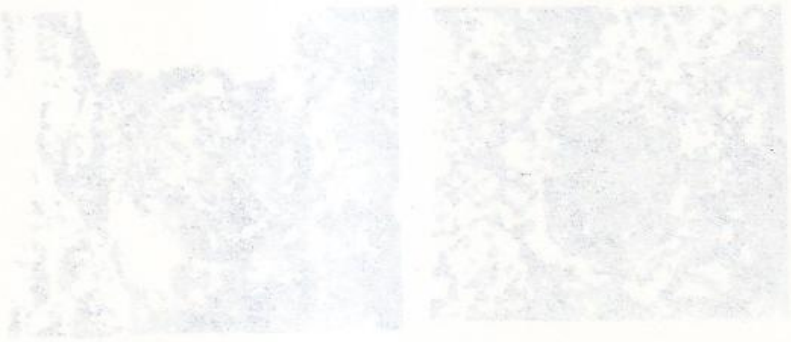

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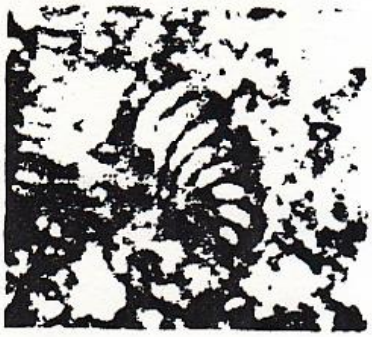

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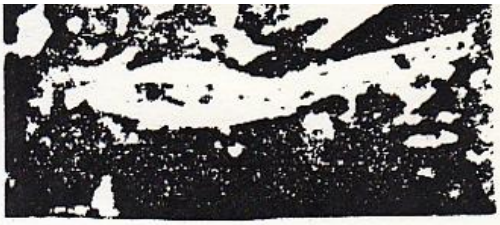

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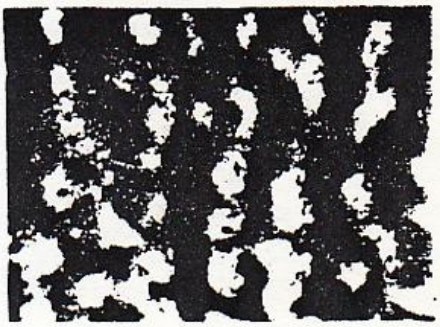

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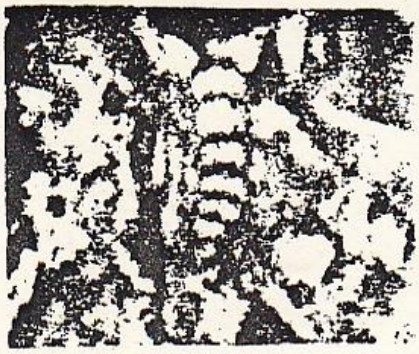
PLATE -4-



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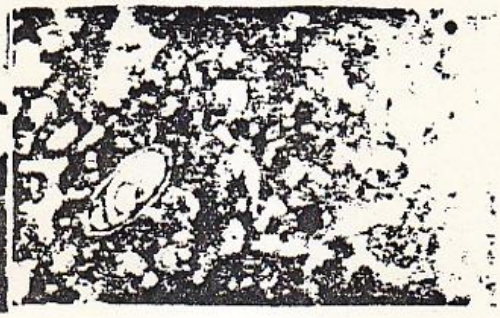

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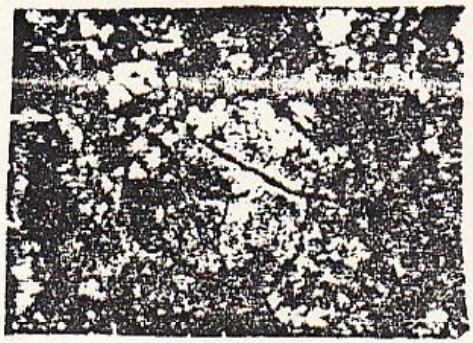

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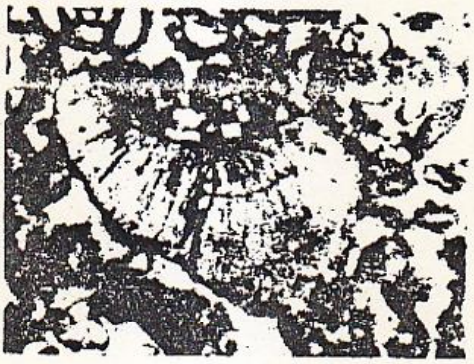

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PLATE _5_

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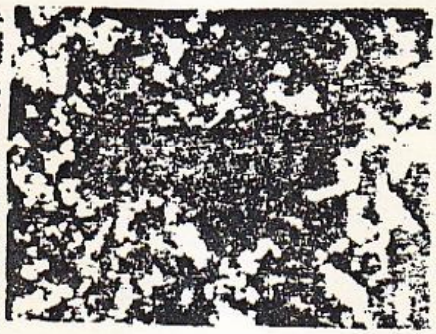

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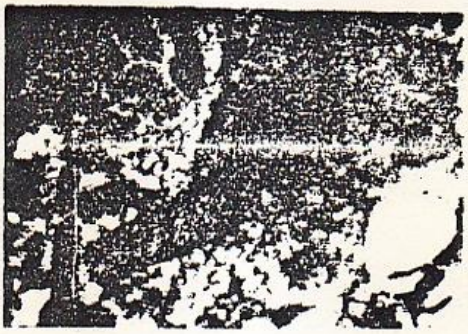

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