

**STRATIGRAPHIC
LEVELS OF
OF THE SOUTH
SI
(ON THE BASIS
Tatiana
TRIASSIC LIMESTONES
KHOTE-ALIN
OF CORAL STUDY)**

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Abstract

Six stratigraphical units, *Coryphyllia moiseevi*, *Volzeia badiotica*, *Margarosmia melnikovae*, *Gablonzeria kipa-risovae*, *Meandrostylis tener*, and *Retiophyllia buonamici* Beds, are suggested for Ladinian-Rhaetian limestones of the South Sikhote-Alin.

1. Introduction

Triassic limestones of the South Sikhote-Alin (Dalnegorsk region) (Fig. 1) contain numerous remains of **scleractinian corals**. The first findings of these organisms described by A.S. Moiseev (1951) are represented by a assemblage *Thecosmilia caesspitosa* Reus var. *ussuriensis* (Moiseev), *Th. angaraensis* (Moiseev), *Th. ex gr. subdichotoma* Volz, *Isastraea ex gr. austriaca* Frech, and *Margarastraea* sp.), that was dated as Carnian. A.S. Moiseev's collection that is stored in Museum of Russian Geological Institute (St. Petersburg) has been sampled in the centre of Dalnegorsk region in the massifs



Fig. 1. Location of Middle and Upper Triassic limestones in Primorye region (Dalnegorsk).

of Sakharnaya,
Partizanskaya, and
Verkhny Rudnik Mountains.
In addition, previous

findings of B. Y. Briner

were included in the work, though they had no good labels and their localities were not indicated exactly enough. Later on, one of the species from this collection was redescribed by T.G. Iljina and G.K. Melnikova (1987). *Thecosmilia angaraensis* Moiseev was proved to be Permian tetracoral (*Donophyllum*). I.V. Buriy et. al. (1986) characterized

briefly Late Ladinian - Late Norian scleractinians sampled from different massifs of the region.

Coral remains

collected often together with bivalves (*Pteria caudata* (Stoppani), *Parallelodon curionii* (Bittner), *Otapiria* cf. *ussuriensis* (Voronetz), etc.) support Triassic age. In the present paper, for the first time, some data on Triassic coral assemblages of Dalnegorsk region are given.

2. Analysis of the Units

2.1. *Coryphyllia moiseevi* Beds (Ladinian-Lower Carnian)

Late Ladinian - Early Carnian coral reef complex is the most ancient of

those distinguished in Dalnegorsk region. It includes individual forms: *Coryphyllia tenuiseptata* Melnikova (Pl. 1), *C. moiseevi* Punina et Melnikova, *C. ex. gr. regularies* Cuif, *Margarophyllia cf. capitata* (Muenster), and *M. inculta* Deng. et Kong. This assemblage was found together with bivalve molluscs - *Pteria insolita* Bittner, *Urma distincta* Bittner etc. and gastropods in marls on the south-west slope of Bolnichnaya Mountain. The

representatives of *Margarophyllia* and *Coryphyllia* are known from Ladinian deposits of China and Cassian Beds of the Alps (Volz, 1896).

2.2. *Volzeia badiotica* Beds (Upper Carnian)

Late Carnian coral assemblages of Dalnegorsk region is mainly represented by dendroid and faceloid forms: *Volzeia subdichotoma* (Muenster) *V. badiotica* Volz, *Pachysolenia primorica* Iljina, *Distichomeandra* sp., *Margarosmia* sp.,

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etc. This assemblage was found together with bivalve molluscs - *Parallelodon currioni* Bittner, *Neoschizodus*

decussatum (Muenster), *Cardita pichleri* Bittner, etc.; conodonts - *Paragondolella* cf. *polygnathiformis* Budurov et Stefanov, *Ancyrogondolella triangularis* Budurov, etc. As the layers of massive and bedded limestones (biostrome), containing this assemblages, are well traced in some massifs (Sakharnaya, Bolnichnaya, Kamennye Vorota, Verkhny Rudnik), they were suggested to be distinguished as the *Volzeia badiotica* Beds. The thickness of the layers (Sakharnaya Mountain) is about 100 m.

2.3. *Margarosmilia melnikovae* Beds (Lower Norian)

Early Norian coral assemblages was determined in biostromes of Sakharnaya, Verkhny Rudnik, Kamennye Vorota, Bolnichnaya, Partizanskaya, and Izvestkovaya Mountains. It is represented by numerous dendroid, faceloid, and cerioid forms: *Margarosmilia charlyana* (Frech), *M. melnikovae* Punina, *M. culta* n. sp. (Pl. 2), *Protoheterastraea konosensis* (Kanmera), *Astraeomorpha confusa* (Winkler), *Retiophyllia weberi* (Vinassa de Regny), *Gablonzeria reussi* Cuif, *Distichomeandra primorica* Punina, and *Stylophylloopsis* sp. This unit was named by the predominant species of this level occurring in all limestone massifs. This assemblage was found together with bivalves - *Halobia* cf. *austriaca* Mojsisovics, *Entolium tridentina* Bittner; conodonts - *Epigondolella abneptis* (Huekeiede), *Metapolygnatus primitia* (Mosher), *M. vialovi* Biryi. The thickness of the *Margarosmilia melnikovae* Beds in the type section (Sakharnaya Mountain) is about 220 m.

2.4. *Gablonzeria kiparisovae* Beds (Middle Norian)

Middle Norian assemblage was found in massive limestones (biogerm) of the same massifs as Early Norian. In it, in addition to previous representatives of the species, we found also: *Gablonzeria kiparisovae* Punina, *G. singularis* Punina, *G. dalnegorica* Punina (Pl. 3), *Toechastraea plana* Cuif, *Retiophyllia fenestrata* (Reuss), *R. norica* (Frech), *Distichomeandra primorica* Punina. The thickness of the *Gablonzeria kiparisovae* Beds in the type section (Sakharnaya Mountain) is about 180 m. This assemblage was found in association with bivalves - *Otapiria ussuriensis chankaika* (Voronetz), *Entolium* cf. *kolyaense* Kiparisova; conodonts - *Epigondolella abneptis* (Huckriede), *Metapolygnathus linguiformis* Hayashi, etc.

2.5. Meandrostylis tener

Beds (Upper Norian)

In the deposits of the reef core of Sakharnaya and Verkhny Rudnik, we found the extensive Late Norian assemblage: *Retiophyllia buonamici* (Stoppani), *R. cyathophylloides* (Frech), *Meandrostylis tener* n. sp. (Pl. 41), *Astraeomorpha crassisepta* Reuss, and *Palaeastraea alnigmata* Punina, etc.

The thickness of the *Meandsostylis tener* Beds in the proposed type section (Sakharnaya Mountain) is about 80 m. The representatives of

Meandrostylis are known from Upper Norian of the South-East Pamirs and the Alps (Melnikova, 1983; Frech, 1890; Roniewicz, 1989). In Dalnegorsk region they are restricted only to this stratigraphic level that allows us to distinguish the

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Meandrostylis tener Beds. This assemblages was found together with bivalves - *Pteria* cf. *tofanae* Bittner, *Tosapecten tetuckensis* Kiparisova, etc.

2.6. *Retiophyllia buonamici* Beds (Rhaetian)

Rhaetian corals in

Dalnegorsk region were found in the area of Verkhny Rudnik and Sakharnaya Mountain. They are represented by dendroid and faceloid colonies of abundant *Retiophyllia cyathophylloides* (Frech), *R. buonamici* (Stoppa), *Heterastraea profunda* Reuss., and *Pamiroseris meriani* Stoppa. This assemblage was found in association with foraminifera - *Triassina hantkeni* Majzon, *Aulotortus sinuosus* (Weynschenk), etc., conodonts - *Misikella posthernsteini* Kozur et Mock. The Beds distinguished were called by the predominant species of the complex - *Retiophyllia buonamici*. The thickness of them in the proposed type section (Sakharnaya Mountain) is about 50 m.

When considering as a whole the coral assemblage of Dalnegorsk region, one can notice that the Late Ladinian - Early Carnian initial stage of carbonate accumulation is characterized by the presence of individual and poorly dendroid corals, and the Late Carnian - Norian - Rhaetian stage, when the intense reef formation took place, is characterized by the presence of colonial forms. When comparing the Dalnegorsk coral complexes with those from other regions, we can see their close similarity at generic level with coral complexes from the South-East Pamirs and the Alps, and at species level - with coral reefs from Japan and China (Iljina T.G., Melnikova G.K., 1986; Melnikova G.K., 1983. Roniewicz E., 1989; Kanmera K., Furukawa, 1964; Xia Jinbao, Liao Weihua, 1986). Below, the new species of reef-building corals are described.

3. Systematics

Family STYLOPHYLLIDAE Frech, 1890

Genus *Meandrostylis* Frech, 1890

Meandrostylis tener n.

sp. Plate 5, figs. 1-3; Plate 4,
figs. 1,2

The name of the species is from *tener* (lat.) - thin.

Holotype - DVGI 460/323, Primorye, Dalnegorsk, Verkhny Rudnik; Upper Norian, *Meandrostylis tener* Beds.

Diagnosis: Colonies cerio-meandroid, septal apparatus consisting of 28-30 septa of the three orders. Calicular mean diameter 5-6 mm.

Description:

Cerio-meandroid colony; cerioid condition permanent. Corallites are star-like, rounded, 5-6 mm in diameter. Corallites are arranged in rows. Septal apparatus irregular, consisting of 28-30 septa of three order. We distinguish 8-9 septa of the first order, the inner ends of which are broken up into individual grains in the centre, and 7-8 septa of the second order. 12-15 septa of the third are more than half the length of septa first order. The septa are

composed of inclined spines arranged in a single row. Microstructure of the spines is fibrous. Interseptal apparatus is represented by tabula-like concave dissepiments. For 1 mm of the corallite height there are 5 dissepiments.

Comparison: It is similar to *Meandrostylis frechi* Haas (Roniewics, 1989, p. 132, pl. 39, fig. 11) in colony structure and septal and interseptal apparatus and differs in smaller sizes of corallites and more numerous septa.

Distribution: Upper Norian, Primorye region.

Material: Four specimens from Dalnegorsk (Verkhny Rudnik), DVGI 460/323, DVGI 460/187, DVGI 460/68, DVGI 460/72.
Family MARGAROPHYLLIIDAE Cuif, 1976
Genus *Margarosmilia* Volz, 1896

Margarosmilia culta n.
sp. Plate 2, figs. 3-5; Plate 5, figs. 4,54

The name of the species is from *cultus* (lat.) - elegans.

Holotype - DVGI 460/229; Primorye, Dalnegorsk, Sakharnaya Mountain; Lower Norian, *Margarosmilia melnikovae* beds.

Diagnosis: Corallites cylindrical, 3-6 mm in average diameter, with 60-80 septa strongly granulated.

Description: Facelodendroid colony reproducing by double fussion. The distance between corallites is 0,2 to 5 mm. Corallites are cylindrical, protothecas are round, 3-6 mm in diameter. Radial elements are septa of four orders, in amounts of 60-80. Septa of the first and second order are about of the same length and strongly ornate with round grains arranged in chess-board order. Septa of the third order are thin and ornamentation is poor. Septa of the fourth order are thin and smooth and reach a half of length of the first order septa. The wall is parathecal, dense and thin (0,2 mm). Interseptal apparatus consists of vesicular, almost round dissepiments. In the peripheral part of the corallite, the dissepiments are more round than in the **centre.**

Comparison: It is similar to *Margarosmia confluens* Volz (Volz, 1896, p. 34, pl. 1, fig. 8-12) in shape and size of protothecas and septum amount. It is characterized by more branched shape of colonies and septum structure. It has more macronate grains on the septa outer margins.

Distribution: Lower Norian, Primorye region.

Material: Five isolated corallites DVGI 229/460, DVGI 229/186, DVGI 229/187, DVGI 229/190. DVGI 229/202 and three fragmentary colonies DVGI 299/461, DVGI 229/465, DVGI 229/185 from Dalnegorsk (Sakharnaya and Verkhny Rudnik).

Stratigraphic Levels of Triassic
Limestones of the South
Sikhote-Alin

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Plate I

Fig. 1-3. *Coryphyllia moiseevi* Punina et

Melnikova, DVGI 186/16, 1

- proximally abraded

corallum, x 1; 2 - transverse section of corallum, x 2,5; 3 - transverse section

of corallum, x 5; Ladinian -

Lower Carnian; Primorye region, Dalnegorsk,

Sakharnaya Mountain.

Fig. 4. *Volzeia subdichotoma* (Muenster) DVGI Dalnegorsk, Verkhny Rudnik.

Fig. 1. *Margarosmilia*

charlyana (Frech), DVGI,

region. Dalnegorsk. Verkhny Rudnik.

Fig. 2. *Margarosmilia melnikovae* Punina, DVGI region, Dalnegorsk, Sakharnaya Mountain.

460/162, transverse section of colony, x 7; Camian; Primorye region,

Plate II

N 460/200, transverse section of Colony, x 5; Lower Norian; Primorye

460/2-86, transverse section of corallites, x 5. Lower Norian, Primorye

Fig. 3-5. *Margarosmilia culta* n. sp., DVGI 460/229: holotype. 3 - transverse

section of colony, x 10; 4 -
transverse section of colony, x
6; 5 - septum in transverse
section showing arrangement
of trabeculae, x 100; Lower
Norian, Primorye region,
Dalnegorsk. Sakhamaya
Mountain.

Plate III

Fig. 1. *Gablonzeria*
Kiparisovae Punina, DVGI
460/4-187, transverse section
of corallites, x 5. Middle
Norian; Primorye region,
Dalnegorsk, Verkhny
Rudnik.

Fig. 2. *Gablonzeria krasnovi*
Punina, DVGI 460/248,

transverse section of
corallites, x 6. Middle
Norian, Primorye region,
Dalnegorsk, Sakhamaya
Mountain.

Fig. 3. *Gablonzeria singulari* Punina, 1
Dalnegorsk, Verkhny Rudnik.

Fig. 4. *Gablonzeria
dalnegorica* Punina

86/200, transverse section
of colony, x 2; Upper
Norian, Primorye region, et
Melnikova, 186/203,
transverse section of
colony, x 20. Middle
Norian;
Primorye region. Dalnegorsk,
Verkhny Rudnik.

Plate IV

Fig. 1-2. *Meandrostylis tener* n. sp., DVGI 460/323: holotype. 1 - transverse section of corallites, x 8: 2 - longitudinal section of colony, x 2: Upper Norian: Primorye region,

Fig. 3-4. *Retiophyllia norica* (Frech), DVGI 460/221: corallites, x 2.

Dalnegorsk, Verkhny Rudnik.

3 - transverse section of corallites, x 3; 4 - transverse section of

Fig. 5. *Retiophyllia buonamici* (Stoppani), Dalnegorsk, Sakhamaya

Mountain.

Fig. 1-3 - *Meandrostylis tener* n. sp., DVGI section of colony. x 15; 3 - transverse section of corallites, x 20; Rudnik.

Fig. 4-5 - *Margarosmilia culta* n. sp., DVGI 460/229: holotype. DVGI 460/159; transverse section of colony, x 2; Rhaetian; Primorye region,

Plate V

460/323: holotype. 1 - transverse section of corallites, x 10; 2 - longitudinal

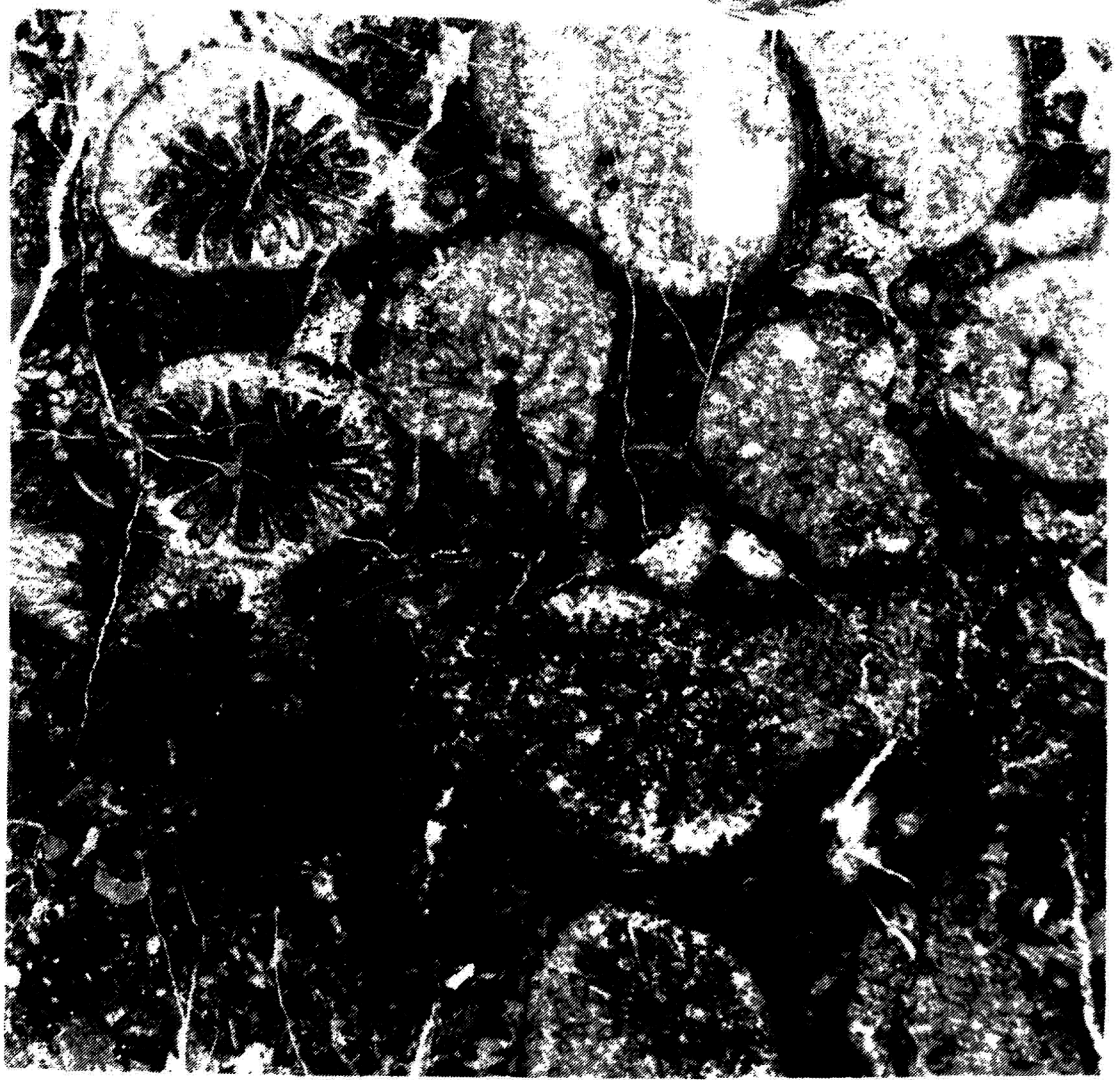
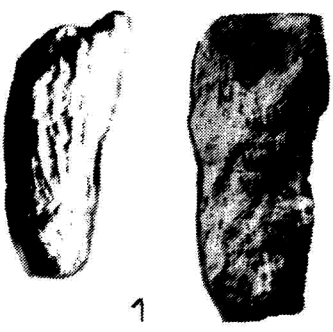
Upper Norian; Primorye
region. Dalnegorsk. Verkhny
4 - transverse section, x 10;
5 - septum in transverse
section showing arrangement
of trabeculae, x 100; Lower
Norian; Primorye region.
Dalnegorsk. Sakhamaya
Mountain. 158

УПЕРНОРИАНСКОЕ ПЕРИОД

Plate I

ИСТОРИЯ НАУКИ И ТЕХНИКИ В СССР

ИЗДАНИЕ ПЕРВОЕ



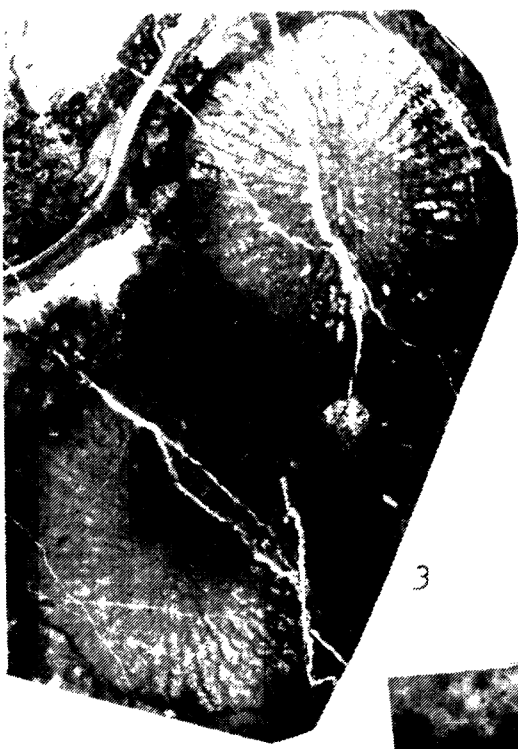
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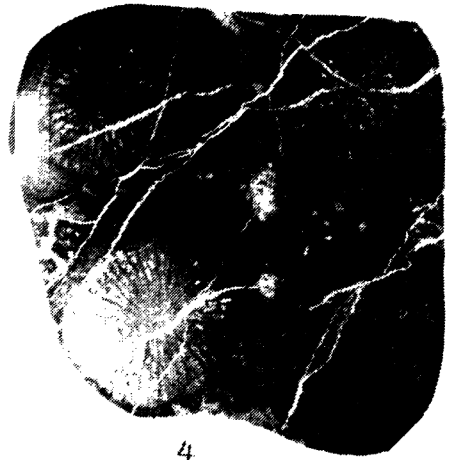
Plate II



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3



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PHOTOMICROGRAPHS OF SECTIONS OF
SANDWICHES OF THE SOUTH
SANTO-SANTO

Plate III

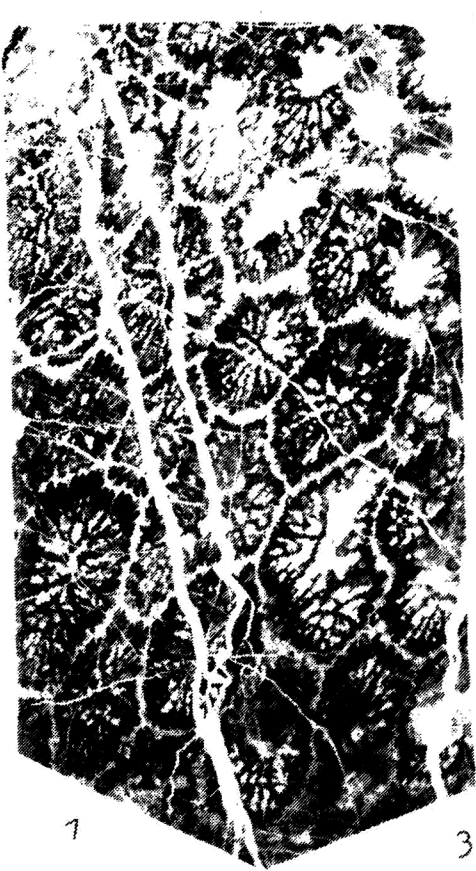
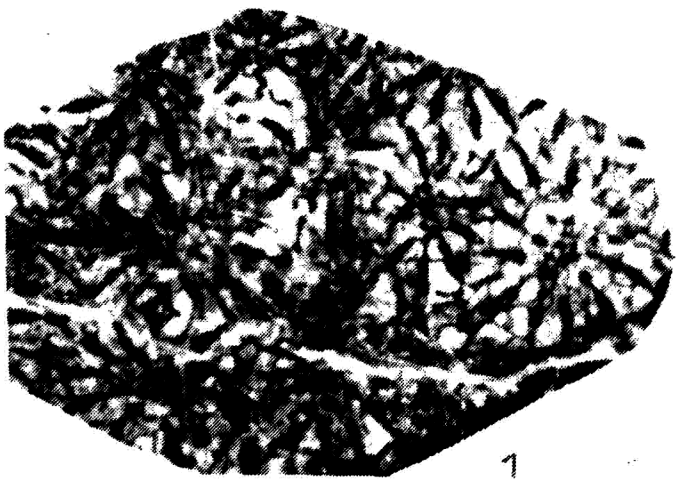
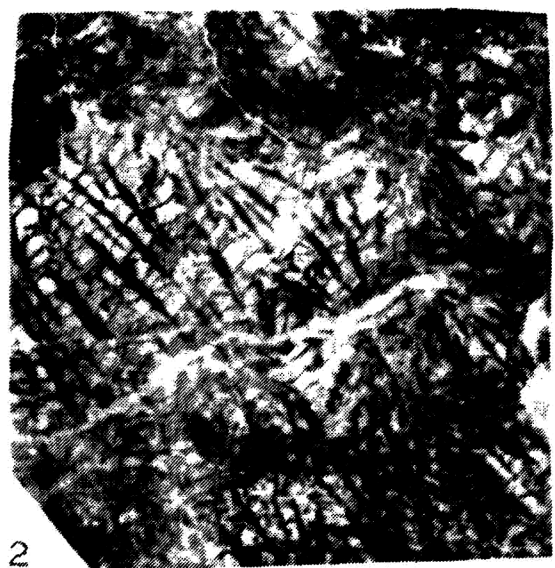


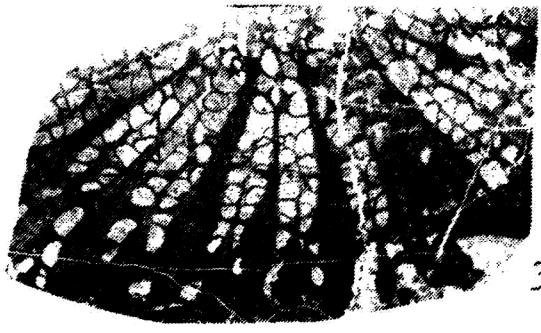
Plate
IV



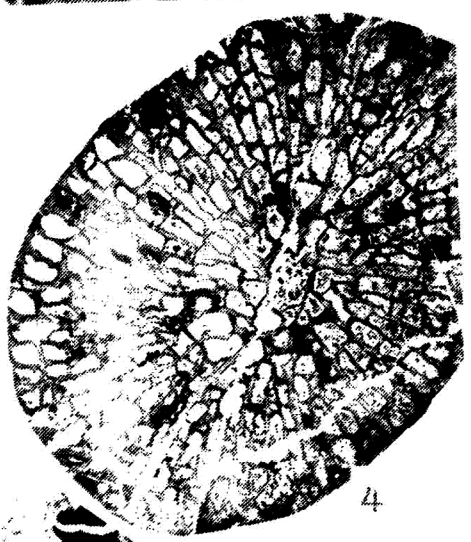
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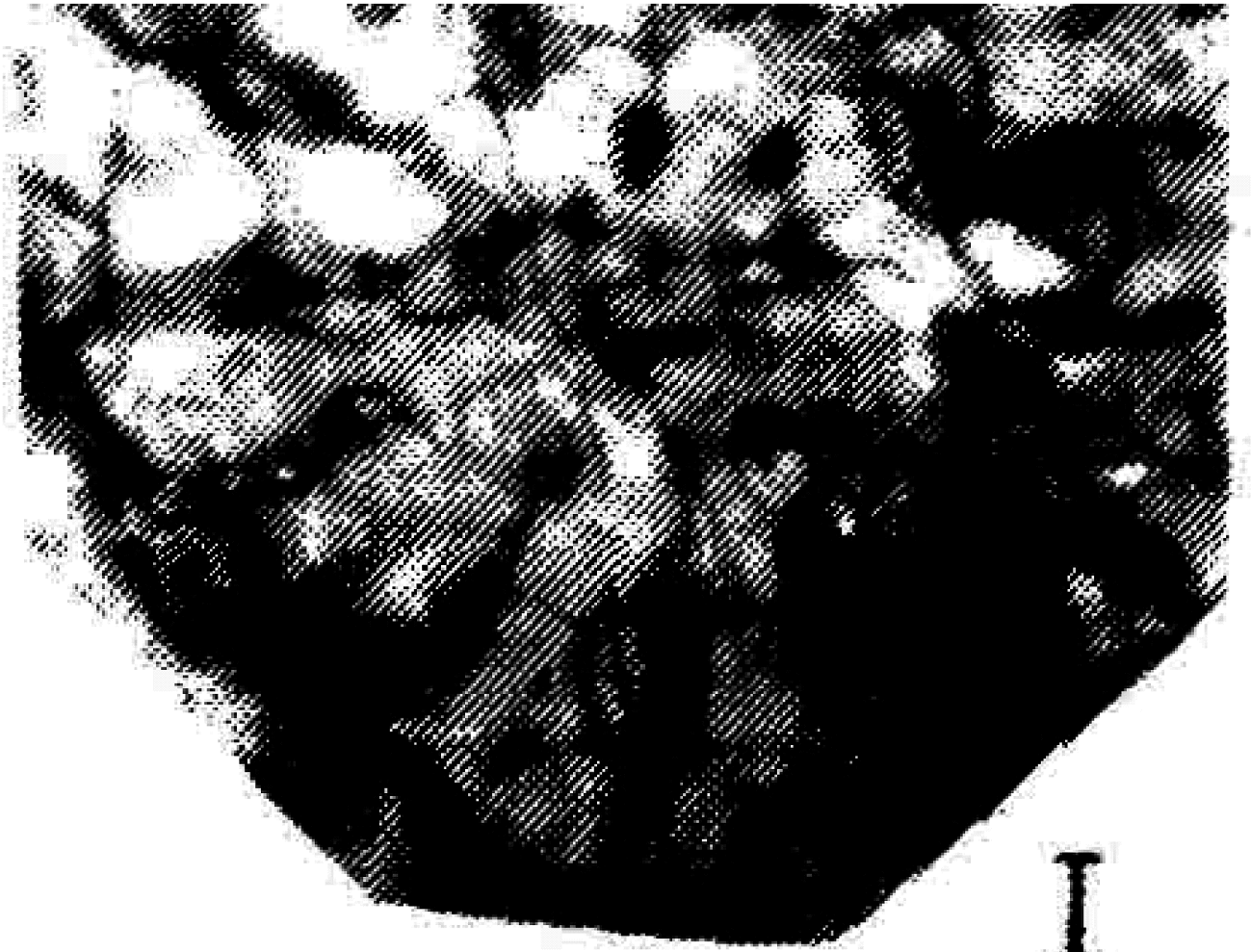
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Micrographical Notes

PLate V

OF CLASSIC LIMESTONES OF THE SOUTH SIKHOTE-LIN





I

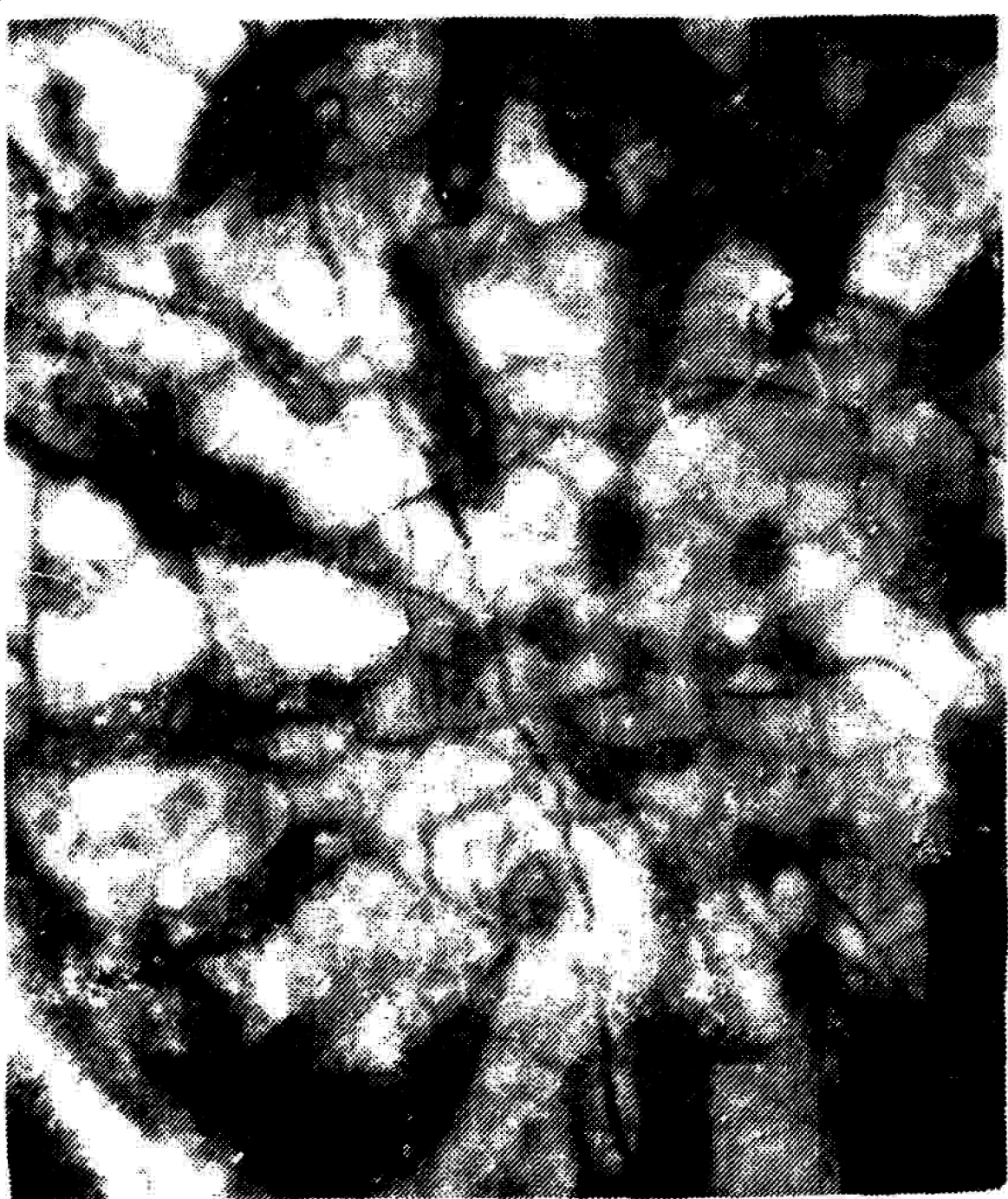




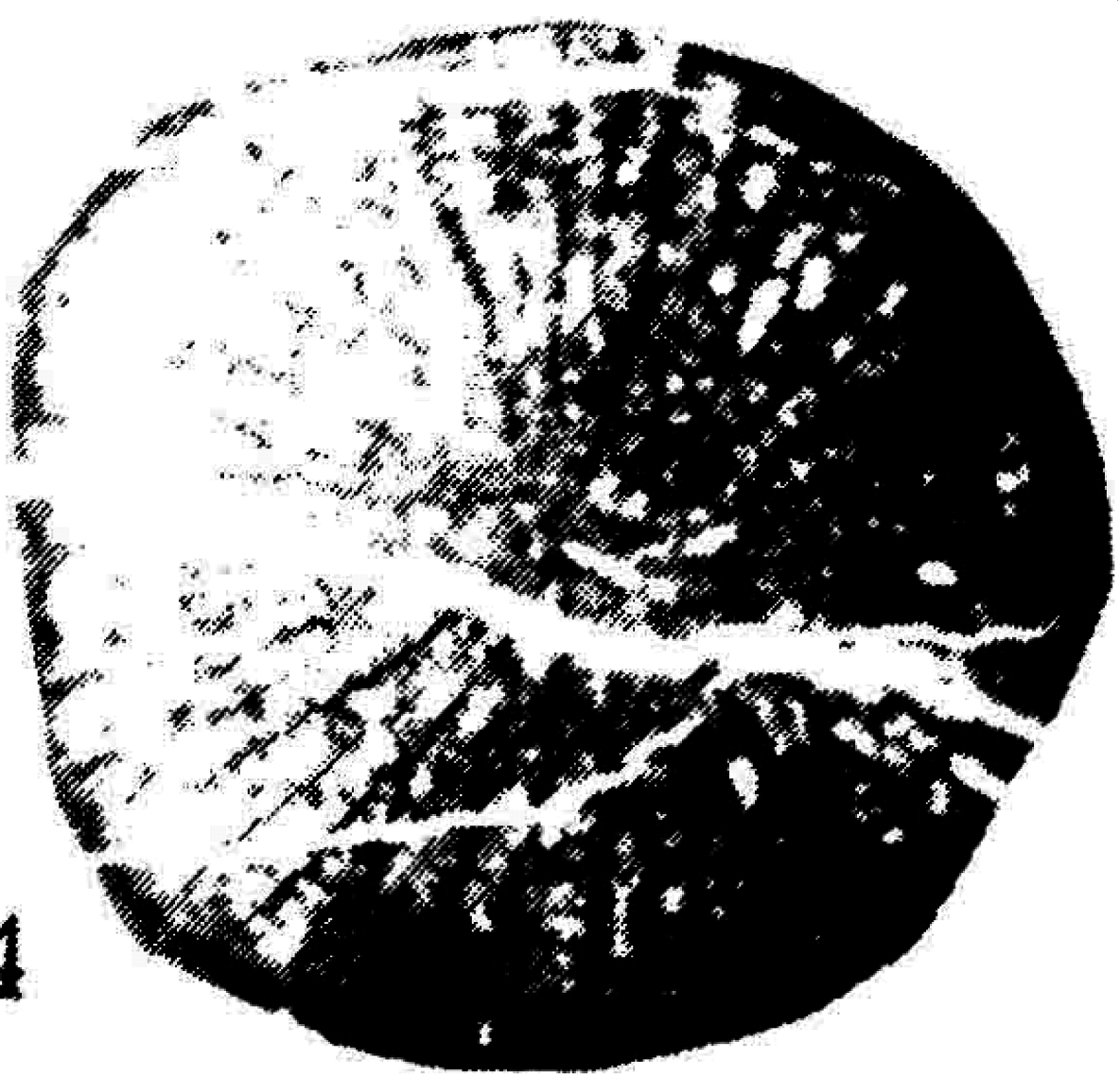
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