SOME PERMIAN CALCAREOUS ALGAE FROM THE VICINITY OF ANKARA

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INTRODUCTION

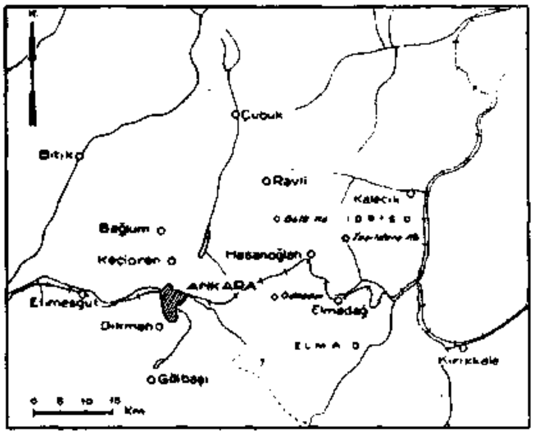

Fig. 1 - Map showing the vicinity of Hasanoğlan

During the summer of 1953 a geological field study was made in the Ankara region in the vicinity of Hasanoğlan village (U. Bilgütay, M.T.A. Report No. 2617, 1957). The author has particularly concentrated her paleontological study on the Permian limestones of the Hasanoğlan-Karacadere area where she was able to identify in these limestones some rather abundant *Fusulinidae* species as well as calcareous algal fossils.

In the area studied fossiliferous Permian formations were observed only in Karacadere locality NE of Hasanoğlan village. However, limestones containing *Fusulinidae* were seen by the author to the NNE on the slopes of the İdris Dağı and to the SSW near Odabaşı village in the locality named Beypınarı (Fig. 1).

This paper describes the calcareous algal fossils consisting of one species of brown algae *(Rhodophyceae),* two of green algae *(Chlorophyceae)* and one species of blue algae *(Cyanophyceae),* all collected from the Karacadere locality in the *Fusulinidae* - bearing limestones.

As will be seen below, the majority of the Foraminifera found together with the algae are represented by large *Fusulinidae.* These Foraminifera were studied by S. Erk, who attributed them -to the Upper Carboniferous-Permian age.

FORAMINIFERA FOUND IN THE ALGAL LIMESTONES

Fusulinidae : *Millerella, Nummulostegina, Ozawainella, Staffella, Triticites, Pseudoschwagerina, Schwagerina, Paleofusulina.*

Other small Foraminifera: *Lunucammina, Endothyra, Plectogyra, Bigenerina, Monogenerina, Textularia, Glomospira, Climacammina, Cribrogenerina, Tetrataxis, Pachyphloia, Ammodiscus, Hemidiscus.*

In addition, some Bryozoa, Ostracod and Coral sections were also observed.

SYSTEMATIC DESCRIPTIONS

Class RHODOPHYTA

Subclass RHODOPHYCEAE

Order Cryptonemiales

Family *CORALLINACEAE*

Genus and sp. ind.

Pl. I, Figs. 1, 2

Among the available sections only one genera was found belonging to the above family. The specimen is in encrusting form and contains large cavities which are probably sporangia. Due to the very poor state of conservation of this sample, it was impossible to make a more detailed study of its structure, hence it cannot be attributed to any definite genus. Since it may prove to belong to a new genus, further studies are being made upon this form.

Class**CHLOROPHYTA**

Subclass CHLOROPHYCEAE

Order **Siphonocladales**

Family *DASYCLADACEAE*

This family which is represented by *Epimastopora* and *Antracoporella* species is widespread in the Hasanoğlan region.

Genus *Antracoporella* PIA, 1920

The original description of this genus was given by Pia (1920, p. 15). Although it closely resembles *Dasyporella* by its long, slender primary branches, and *Vermiporella* by its branching thallus, it is distinguished from them by its dichotomous primary branches. At the same time, the fact that the sample studied is larger in size than the comparable species constitutes also a point of difference. No reproductive organs were observed. According to Pia, the spores may have developed in the central cell. The pores are irregular. This family is represented only by one individual known from the Upper Carboniferous of the eastern portion of the southern Alps.

Antracoporella spectabilis PIA, 1920

Pl. I, Figs. 3, 4

A. spectabilis Pia, 1920, Abh. Zool. - Botan. Gesellschaft in Wien, Bd. XI, Heft 2, p. 15, Taf. I, Figs. 7-11.

Description of specimen. — Thallus cylindrical, not segmented, probably having dichotomous branching (a branch-like projection, which may be interpreted as branching, was observed in this specimen). Its calcareous wall is perforated by numerous regular pores. These pores represent the outward openings of the primary branches with uniform width throughout their entire length. About

147 - 172 pores to 1 mm^2 were observed. In general, it is impossible to distinguish as primary and secondary the lateral branches radiating from the central cell. However, there are small secondary branches parting at acute angles from the primary branches which do not differ in size from the latter, and this branching takes place at different levels. Usually, the branches are placed at right angles to the central stem. No evidence indicating a second dichotomizing on the same branch could be definitely observed.

Dimensions of the alga according to the available specimen :

Outer diameter: 1.92 mm
Inner diameter : 0.92 mm
Thickness of the wall: 0.45 mm
Diameter of the pore : 0.06 mm.

Remarks. --- The specimen seems to conform exactly in all its characteristics, general appearance and dimensions to the description given by Pia. Therefore it has been attributed to the same species.

Occurrence. — In the Lower Permian limestones associated with *Schwagerinina,* at the locality of Karacadere in the vicinity of Hasanoğlan near Ankara.

Other localities. — Europe, Karnic Alps; in the Upper Carboniferous limestone beds associated with *Fusulinidae.*

Asia Minor: Kargı locality, Kastamonu,

Genus *Epimastopora* PIA, 1922

The original description of this genus was made by Pia who gave a very hypothetical reconstruction. However, later on he added the following observations (Pia, 1937, p. 828) : «Unfortunately there are only fragmentary pictures available of this fossil and it is very difficult to judge from them the general structure and systematic position. Frequently, these fragments appear straight in thin sections. Sometimes they are curved and in exceptional cases they are S-shaped. If, as I have assumed, these imply remains of spherical bodies, then they must have been several centimeters in diameter.. . Recognition of the general form is also made difficult because the skeleton is broken. The fragments are perforated by numerous large, round or polygonal pores.» (see Johnson, 1946, p. 1095). Unfortunately, in this description Pia did not furnish any measurements and supplied only one picture (Pl. 97, Fig. 4). The material used by Pia is from the Lower Permian Trogkofl limestones of the Karawanken and Karnic Alps.

J. H. Johnson (1946) makes the following addition to Pia's original description :

« The limestones from Kansas contain abundant pieces of an algal form that exactly fits Pia's picture and description of *Epimastopora.* The specimens represent horizons ranging from low in the Middle Permsylvanian up to the Lower Permian.»

Pia (1922, p. 65) believes that this form is related to *Mastopora.* However, *Mastopora,* which is not so well known, is found in the Silurian and next—

after a long stratigraphic jump—it is encountered in the Middle Carboniferous, probably as a better-developed form represented by the genus *Epimastopora.* In Turkey *Mastopora* has not been found; this might be due to limited Silurian outcrops.

According to Wood (1943, p. 209), *Epimastopora* and *Koninckopora* are very closely related to one another. The present writer, after studying Wood's description and figures and some *Koninckopora* from her own material, is convinced that these two forms are very much alike but still belong to two different genera.

Epimastopora piae n. sp.

Pl. II, Figs. 1-4

Description of specimen.— Thallus consists of long, cylindrical tubes and has a relatively large central cavity from which emerge perpendicular primary branches. The secondary branches were observed with difficulty only in two points of one section.

Among the various samples studied no indication of the tertiary branching was encountered. No sporangia were observed. However, it was possible to distinguish in one sample some pear-shaped, relatively thick members appearing among narrow, slender primary branches, which are probably analogous with them. It is highly probable that these members correspond to sporangia (Fig. 2.c). These sporangia are attached by a slender stem to the central cavity and end in a pore on the outside. Dimensions of the sporangia : 100 x 72.5 microns, while the stern measures 50x25 microns.

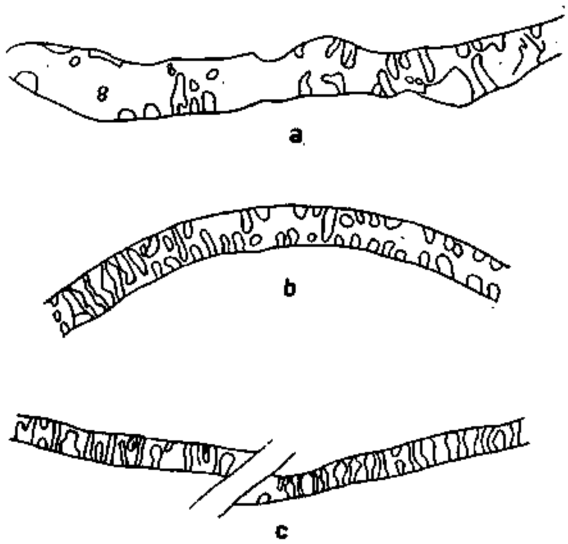

Fig. 2 - a, b: Longitudinal section of sterile branch 21.2×
c: Longitudinal section of fertile branch 21.2×

However, here a problem arises which creates some doubt. Gould it be possible that our fertile specimens, which are more slender and of smaller dimensions than our sterile specimens, belong to a different species? Nevertheless, the writer is inclined to believe that they belong to the same species, judging from their identical general appearance and the fact that in the same thin-sections the sterile branches are found side by side with the sporangia-bearing branches. A similar case was observed by the author in an other species.

The outer wall of the alga is perforated by polygonal or round pores. These pores represent the openings of the branches towards the exterior.

The dimensions of this alga taken from numerous sections arc shown in the following table.

Dimensions of *Epimastopora piae* n. sp.

mm	*Longitudinal section of sterile thallus*					*Transversal section of sterile thallus*			*Tangential section of sterile thallus*		*Oblique section of sterile thallus*	*Long. sect. of fertile thallus*
L *Length of thallus*	10.080	—	—	—	—	—	—	—	—	—	—	—
D *Outer diameter*	6.384	—	-	—		5.980	—	—	—	—	—	—
d *Inner diameter*	5.640	—	—	—	—	5.112	-	—	—	—	—	—
s *Wall thickness*	0.336 0.340	0.360	0.220	0.240 0.264	0.240 0.360	0.336 0.340	0.240 0.312	0.231 0.388	—	—	0.315 0.360	0.165 0.198
Diameter of lateral branches	—	0.055	0.072 0.096	0.055 0.066	0.033 0.072	0.077	0.072	0.077	—	—	0.096	0.017
Distance between lateral branches	—	—	0.024	—	—	0.022 0.033	—	—	—	—	—	0.028 0.050
p *Diameter of pores*	—	0.088 0.121	0.066 0.088	0.055	0.055	—	0.088 0.110	0.077	0.066 0.099	0.066 0.055	—	—
Distance between pores		0.033	0.072 0.096	0.011 0.022	0.055	—	—	—	0,010 0.020	0.022	—	—
Coll. No.	19					19			19		19	19

Remarks. — Our specimen fits Pia's (1937) figures and descriptions, but Pia gives no measurements. According to the measurements that we took from Pia's photograph, his specimens seem to be slightly larger than ours. These measurements may not be exact, however their general appearance is so similar that it is believed that Pia's forms from the Lower Permian of Europe and the Turkish forms are identical.

Although *Epimastopora piae* approaches *E. kansasensis* Johnson by the diameter size of its lateral branches and by the distance between them, its walls are thinner in comparison to the American form. It differs also from *E. jewetti* Johnson, the lateral branches of our specimen being wider and denser; moreover the pores of the Turkish form are smaller and more closely spaced. Similarly, our specimen may be distinguished from *E. regulnris* Johnson because of its wider and denser lateral branches and also because the pores of *E. piae* are nearly of the same size and more closely spaced. Likewise, *E.* sp. A Johnson and *E.* sp. B Johnson are distinguished from our specimen in having narrower and less densely-spaced lateral branches. Although the diameter of the pores in *E.* sp. C Johnson corresponds to our dimensions, it is impossible to compare these forms owing to insufficient description and measurements of the former. The Turkish form is particularly distinguished from *E. minima* Elliott being considerably larger in size than the latter.

Occurrence. — Ankara-Hasanoğlan, in the locality of Karacadere; in the Lower Permian limestones associated with *Girvanella* and *Schwagerinina* (U. Bilgütay, Coll. No. 19).

Other localities-— Europe : In Lower Permian Trogkofl limestones in Karawanken and Karnic Alps.

Epimastopora ketini n. sp.

Pl. II, Fig. 5; Pl. III, Figs. 1-3

Among our material only one transversal section was observed which belongs to this species. As this single specimen was not sufficient for the establishment of a new species, İ. Ketin who visited the same region in 1958 has kindly supplied numerous thin-slides of this species. These samples were collected by him from the Fusulinid limestones in the same locality. Grateful thanks are expressed here to Prof. İ. Ketin for making available the necessary material and as an appreciation of his valuable help this new species is dedicated to him.

Description of specimen. — Thallus consists of long, cylindrical tubes, circular in transversal sections. The calcareous wall which surrounds the central cavity is traversed by primary branches ending in pores. Although secondary branching was clearly seen, no tertiary branching could be observed. The surface is covered by relatively small, closely-spaced pores. In our fertile specimens, which are comparatively smaller than the sterile forms, some of the primary branches developed into sporangia-like swellings which may be reproductive organs.

Dimensions. — Sporangia : 66 x 66-77 microns; stem : 22-25 x 33-44 microns.

Dimensions of *Epimastopora ketini* n. sp.

mm	*Longitudinal section of sterile thallus*		*Transversal section of sterile thallus*	
L *Length of thallus*	3.984	3.408	—	—
D *Outer diameter*	—	1.008	1.680	1.512
d *Inner diameter*	—	0.528	1.080	0.960
s *Wall thickness*	0.360	0.240	0.240 - 0.360	0.220
Diameter of lateral branches	0.055 - 0.066	0.055	0.066	0.055
Distance between lateral branches	0.024 - 0.048	0.022	—	—
p *Diameter of pores*	—	0.055	—	0.033 - 0.055
Distance between pores	—	0.022	—	0.011 - 0.033
Coll. No.	18/7	18/7	19	18/7

Remarks. — *Epimastopora ketini* is similar in general appearance to *E. piae.* The first impression of its longitudinal section- strongly reminds of this species. However, the fact that their measurements are distinctly different authorizes the writer to erect a new species. *E. minima* Elliott (1956) is distinguishable from our specimen by its small size. The American forms differ from our specimen in their appearance as well as their size. This difference in appearance is due to the following features : the wall of *E. kansasensis* Johnson is thinner, while its lateral branches are considerably thicker and denser; the lateral branches of *E. jewetti* Johnson are narrower and denser with closely - spaced smaller pores; the lateral branches of *E. regularis* Johnson are wider and denser, while its pores are smaller and more closely spaced. As no detailed description was given by the author regarding *E.* sp. A Johnson, *E* sp. B Johnson and *E.* sp. C Johnson, the table on the opposite page showing their respective measurements will serve for a comparative study.

Occurrence. — Hasanoğlan, Karacadere area, vicinity of Ankara; in the Lower Permian limestones associated with *Girvanella* and *Schwagerinina.*

Order Siphonales

Family *CODIACEAE*

Genus *Anchicodium* JOHNSON, 1946

This genus which was found by Johnson (1946) in the Upper Pennsylvanian formations of Kansas resembles the modern *Codium;* it differs from *Gymnocodium* in the shape of its thallus which is very slender, without any noticeable thickenings or constrictions; its sporangia are not conspicuous. It is differentiated according to the size of its branches and algal filaments.

Anchicodium ankarensis n. sp.

Pl. III, Figs. 4-7

Description of specimen. — Characteristic features of this species are its general appearance and long cylindrical shape. Thallus regular, without any thickening and constricting of members. Calcification slight. The filaments run parallel in the central cavity of the thallus; they are directed from the interior outwards, perpendicular to the sides and branching off at the marginal end. The longest of the thallus measures 3.6 mm in length and 0.816-1.128 mm in widih. Diameter of the algal filaments varies from 0 022 to 0.033 mm. The central algal filaments, which run parallel to the longitudinal section of the thallus, expand into swellings. In some of the transversal sections dark-colored, round cavities were observed in the central parts. It is highly probable that these swellings of the algal filaments represent their reproductive organs.

Width of the filaments: 0.096-0.120 mm; diameter of the cavities in transversal section: 0.072-0.144 mm. It seems that the question of the reproductive organs is thus explained. In conclusion it can be said that these swellings of the algal filaments are actually their reproductive organs.

Comparative table of the known *Epimastopora* species

mm	*E. PIA*	*E. piae* n. sp.	*E. ketini* n. sp.	*E. kansasensis*	*E. jewetti*	*E. regularis*	*E.* sp. A	*E.* sp. B	*E.* sp. C	*E. minima*
L *Length*	4.550	10.080	3.408-3.984	15	—	—	—	—	—	—
D *Outer diameter*	—	5.980 6.380	1.008-1.68	—	—	—	—	—	—	0.5
d *Inner diameter.*	—	5.110 5.640	0.528-1.08	—	—	—	—	—	—	0.065
s *Wall thickness*	0.410	0.220 0.360	0.22-0.36	0.65 0.9(0.85)	—	—	—	—		0.182
Diameter of lateral branches	0.080 0.140	0.055 0.096 (0.077)	0.055-0.066	0.05 0.08	0.031-0.065 (0.042)	0.03-0.044	0.05	0.03-0.05	slender	—
Distance between lateral branches	0.025 0.055	0.022 0.050	0.022-0.048	0.067 0.011	0.055-0.062	0.08-0.14	0.3-0.48	0.05-0.06	close	—
p *Diameter of pores*	0.100	0.050 0.100	0.033-0.055	0.07-0.11 (0.04-0.05)	0.11-0.14	0.07-0.09	—	—	0.057-0.08	in few places 0.026
Distance between pores	0.025	0.010 0.096	0.011-0.033	0.02	0.05-0.1	0.028-0.033	—	—	irregular	—

Discussion. — This new species is much larger than any of the forms described by Johnson (1946). By the large size of its thallus it approaches only *Anchicodium plumosum* Johnson, but differs from it in having wide algal filaments and a regular thallus (i.e. thallus is not divided into thickened and constricted areas). Likewise, the two group specimens of. *Anchicodium* sp. Konishi (1956) may be distinguished from our specimen by their thallus which is smaller in size. On the other hand, the diameter of their algal filaments approaches the dimensions of our specimen.

Occurrence- — Hasanoğlan, Karacadere area, vicinity of Ankara; in the Lower Permian limestones associated with *Girvanella, Epimastopora* and *Schwagerinina* (İ. Ketin, Coll. No. 18/7).

Class **CYANOPHYTA**

Subclass CYANOPHYCEAE

Family *POROSTROMA*

Genus *Girvanella* NICHOLSON and ETHERIDGE, 1878

Giruanella. — Monograph of the Silurian Fossils of the Girvan District in Ayrshire, Part I, 1878.

«Microscopic tubuli with arenaceous or calcareous (?) walls, flexuous or contorted circular in section, forming loosely compacted masses. The tubes apparently simple cylinders, without perforation in their sides, and destitute of internal partitions or other structures of similar kind.» (Nicholson and Etheridge, 1878, p. 23). The species corresponding to this description was named *G. problematica* Nich. and Eth.

Later on various *Girvanella* species were found in various formations ranging in age from Silurian to Cretaceous, which enabled the author to give a more detailed description of this genus.

Girvanella ducii WEFH., 1890

Pl. III, Figs. 8-9; Pl. IV, Figs. 1, 2, 3a

Girvanella. — E. Wethered, 1890, On the Occurrence of the Genus Girvanella in Oolitic Rocks and Remarks on Oolitic Structure. The Quart. Jour, of the Geol. Soc. of London, vol. 46, pp. 270-283, pl. XI, figs. 2a, *b, c.*

Girvanella ducii Garwood, 1913, Geol. Mag , dec. V, vol. X, p. 498.

?Girvanelii ducii Garwood, 1916, Proc. Geol. Assoc., vol. 27, p. 1, London.

Girvanella ducii Garwood and Goodyear, 1924, Quart. Jour. Geol. Soc. London, vol. 80, p. 200, pl. 19, fig. 2.

Girvanella ducii Pia, 1926b, Planzen als Gesteinsbildner. Berlin, fig. 15a.

Girvanella ducii Masloff, 1929, Ball. Com. Geol. Leningrad, vol. 48, p. 134, pl. 70, fig. 1.

Girvanella sp. Le Maitre, 1930, Ann. Soc. Geol. du Nord, vol. 55, p. 43, pl. 3, figs. 14-15.

Girvanella ducii Garwood, 1931a, Quart. Jour, Geol. Soc. London, vol. 87, p. 140 (Lille).

Girvanella ducii Pia, 1932a, Bull. Acad. Sc. de l'URSS. Cl. Sc. Math, et Nat., p. 1350.

Gvvanella ducii Pia, 1933a, Akad. der Wissenschaften in Wien math. nat. Wien, p. 94.

? *Girvanella* Milon, 1932, C. R. Somm. Soc. Geol. de France, p. 68.

Girvanella Milon, 1933 C. R. Somm. Soc. Geol. de France, p. 70.

Girvanella ducii Maslov, 1935 Trans. All. Union Scientif. Research Inst. Econom. Mineral, fasc. 72, p. 21.

Girvanella ducii Lecornpte, 1936, Mem. Inst. Geol. Univ. Louvain, vol. 10 p. 84.

Girvanella ducii Pia, 1937, Compte Rendu 2eme Congres Carbonifere, tome II, p. 783.

? *Girvanella moorei* Johnson, 1946, Bull. Geol. Soc. America, vol. 57, p. 1100.

Girvanella aff. *ducii* Johnson, 1946, Bull. Geol. Soc. America, vol. 57, p. 1101.

Description of specimen. — This specimen consists generally of relatively straight or slightly flexuous tubes with well-defined walls. Sometimes these tubes can be observed in regular concentric patterns encircling some foreign matter forming small granules (measuring 0.262x0.6, 0.244x0.33, 0.48x0.96 mm) or appearing as loosely-arranged masses. The inner diameter of tubes ranges from 0.0125 mm to, 0.0200 mm. The wall thickness of the algal filaments is 0.005 mm, the distance between filaments being 0.0075 mm. These tube-like algal filaments are frequently branching; transverse partitions are also observed.

Here, an important point should be taken into consideration : the question of measuring the diameter of the tubes. The section of the filaments to be measured should pass exactly through their center, otherwise in tangential section they will appear as deceptively narrow lumens.

Remarks. — The species with its loosely arranged masses, small granules or rounded ooids resembles *G. ducii* Weth. This similarity is further confirmed by the diameter of the algal filaments which frequently attain 0.02 mm. Hence, we conclude that our specimen is identical with *G ducii* Weth. The only difference observed is that in the Turkish form the algal filaments are less flexuous and twisted than in *G. ducii* Weth.

Pia (1937, p. 820) mentions a form—without giving its name—which was found in the Permian formation in the vicinity of Orenburg, Russia. According to him, the Russian sp cies which- has algal filaments with a diameter of 0.02-0.025 mm may be identical with *G. ducii* Weth. This character approaches it also to the Turkish form.

G. moorei Johnson (1946, p. 1100), which approaches our specimen by the dimensions of its algal filaments (diameter : 0.017-0.019 mm), displays other points of resemblance with our form in having well-defined filament walls and colonies growing around organic matter or forming spherical granules. However, it is distinguished from our specimen in having considerably more twisted algal filaments and absence of branching.

G. aff. *ducii* Weth. (Johnson, 1946, p. 1101) also has colonies growing around organic matter or small irregular granules. However, the diameter of its filaments being somewhat larger (0.0225-0.0286 mm) it differs from our specimen.

Occurrence.— Ankara-Hasanoğlan, Karacadere locality; in the Lower Permian limestones associated with *Schwagerinina, Epimastopora* and *Anchicodium.*

Other localities. — Europe : England, in the Carboniferous limestones of Gloucestershire.

Russia : In Oural Mountains, Donetz Basin, and in the Permian formations of Orenburg.

U. S. A. : In the Upper Pennsylvanian limestones in the Jefferson and Riley Counties and in Lower Permian limestones of the Marshall County, Kansas.

Girvanella cf. *incrustans* WETHERED, 1890
Pl. IV, Fig. 3b; Pl. V, Figs. 1-4

Girvanella incrustans Wethered, 1890, Quart. Jour, of Geol. Soc., vol. 46, p. 280, pl. 11, figs, *la, b,* London.

Girvanella incrustans Garwood, 1913, Geol. Mag., vol. 10, p. 498, London.

Girvanella incrustans Garwood, 1931a, Quart. Jour, of Geol. Soc., vol. 87, p. 140, London.

Girvanella incrustans Pia, 1933, Akad. der Wis. in Wien, p. 96.

G. staminea Garwood ? = *G. incrustans* Pia, 1937, 2[e] Congr. Strat. Carbonif. Heerlen, 1935, Compte Rendu, p. 784, pl. 4, fig. 3.

Description of specimen. — Our specimen consists of strongly coiled filaments forming loosely arranged masses or closely packed threads encircling other fossils. The inner diameter of the algal filaments ranges from 0.0075-0.01 mm, transversal sections are round. No well-defined transverse partitions or branching were observed in the tubes.

Remarks. — All known *Girvanella* species are classified according to the width of their algal filaments. The species which most approach our form in this character are shown in the list on the opposite page.

Aside from the three Mesozoic species mentioned in this list, *G. sinensis* is the only species which differs from *G.* cf. *incrustans.* The former has more or less concentric cell filaments appearing as massive nodules, which form pseudo-oolitic structures, while our species is characterized by irregular cell filaments forming loosely-packed ooids or growing around foreign matter. It is due to the same characteristic differences that Yabe distinguishes *G. sinensis* from *G. problematica.*

Concluding from the above observations and from the comparison of the available literature on the remaining species in our list, and taking into consideration that these forms may be synonymous, the writer feels justified in using the name of *G. incrustans* Wethered for our species (in accordance with the International Regulations for Zoological Nomenclature) since Wethered was the first to identify this species.

Girvanella species with diameter of algal filaments
approx. 0.01 mm

Name of fossil	*Age*	*Original description*
G. incrustans Weth.	Lower Carboniferous	Weth., 1890, p. 280, pl. 11, fig. 1*a-b*.
G. wetheredi Chapman	Silurian-Lower Carboniferous	Chapman, 1907, p. 383
G. incrustans Chapman	Silurian-Lower Carboniferous	Chapman 1907, p. 13
G. sinensis Yabe	Carboniferous (? Upper Carboniferous)	Yabe, 1912-1914, p. 1
G. incrustans var. *lucii* Weth.	Jurassic	Weth., 1890, p. 280, pl. 11, fig. 3
G. intermedia Weth.	Jurassic	Weth., 1890, p. 281, pl. 11, fig. 7
G. tosaensis Yabe-Toyama	Lower Cretaceous	Yabe-Toyama, 1928, p. 151, pl. 23, fig. 4-6

It looks as if both Garwood and Pia—as can be observed from their numerous works—do not attach any particular importance to the variety in the diameter size of the algal cell filaments as main criterium in distinguishing the species. For instance, while Wethered distinguished the *Girvanella* species—-which he first attributed to Rhizopoda—according 10 the diameter size of their tubes : those having 0.01 mm as *G. incrustans* Weth. and the ones measuring 0,02 mm as *G. ducii* Weth., Garwood (1913, p. 498) does not seem to take this into consideration and identifies *G. incrustans* and *G. ducii* as *G. incrustans* Weth. fide Garwood. The conception of II. Johnson is similar: in his descriptions the tube of *G.* aff. *ducii* has a diameter of 0.0286 mm, which is 0.008 mm wider than the diameter of *G. ducii* Weth. Likewise, Pia (1933, p. 97; 1937, p. 784) is inclined to give the name of *G. incrustans* Weth. to *G. astaminea* Garwood, which has cell filaments with a diameter of 0.007 mm.

Judging from the above observations, it looks as if the *Girvanella* species although the diameter of their cells ranges from 0.007 to 0.028 mm may be united under the same name. The writer,-however, feels that it is too early to give any definite opinion on this subject; it is believed that for a better systematic classification a revision is necessary. Taking into consideration this situation the, author identified the Turkish specimen with cf.

Occurrence.— Hasanoğlan, Ankara, in the Karacadere locality; in the Lower Permian limestones associated with *Schwagerinina, Epimastopora* and *Anchicodiuni* (İ. Ketin, Coll. No. 18/7; U. Bilgütay, Coll. No. 19).

Other localities.— England; Gloucestefshire, in the Carboniferous limestones.

In the Hasanoğlan limestones described above sections of *Aeolissaccus dunningtoni* Elliott have been found.

CONCLUSION

As the result of the paleontological studies of the limestone samples collected from the vicinity of Hasanoğlan, Ankara, the writer concludes that the age of these limestones is Lower Permian.

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EXPLANATION OF PLATES
(All figures from Hasanoğlan-Ankara)

PLATE I
Corallinaceae ind. and Antracoporella

Fig. 1,2 — *Corallinaceae* ind.
Fig. 3 — *Antracoporella spectabilis* Pia. Longitudinal section 10 x
Fig. 4 — *Anlracoporella spectabilis* Pia. Transversal section 10 x

PLATE II
Epimastopora

Fig. 1 —- *Epimastopora piae* n. sp. Transversal section 10 x
Fig. 2 *Epimastopora piae* n. sp. Tangential section 10 x
Fig. 3 — *Epimastopora piae* n. sp. Transversal section 25 x
Fig. 4 — *Epimastopora piae* n. sp. Longitudinal section 10 x
Fig. 5 — *Epimastopora ketini* n. sp. Longitudinal section 20 x

PLATE III
Epimastopora, Anchicodium and Girvanella

Fig. 1 — *Epimastopora ketini* n. sp. Tangential section 20 X
Fig. 2,3 — *Epimastopora ketini* n. sp. Transversal section 20 x
Fig. 4 —- *Anchicodium ankarensis* n. sp. Longitudinal section 20 X
Fig. 5,7 — *Anchicodium ankaransis* n. sp. Transversal section 20 X
Fig. 8 — *Girvanella ducii* Weth. (encircling test of *Pseudoschwagerina)* 4P x
Fip. 9 *Girvanella ducii* Weth. 40 x

PLATE IV
Girvanella

Fig. 1,2 — *Girvanella ducii* Weth. 40 x
Fig. 3 — *Girvanella ducii* Weth. *(a)* and *Girvanella incrustans* Weth. *(b)* (on the same figure) 40 x

PLATE V
Girvanella

Fig. 1 — *Girvanella incrustans* Weth. 59 x
Fig. 2,4 — *Girvanella incrvstans* Weth. 40 x

Fig. 1

Fig. 2

Fig. 3 10×

Fig. 4 10×

Fig. 1 10 ×

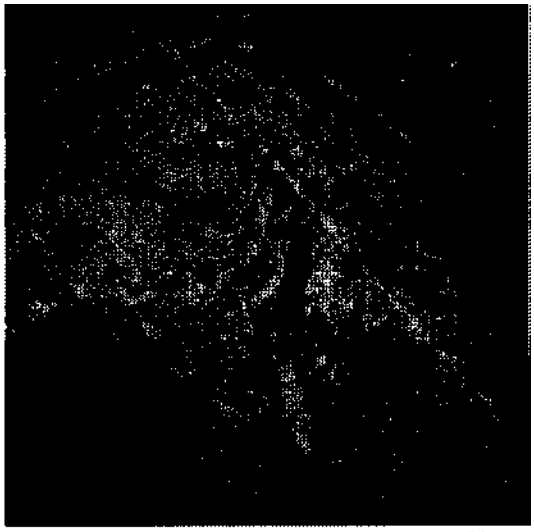

Fig. 2 10 ×

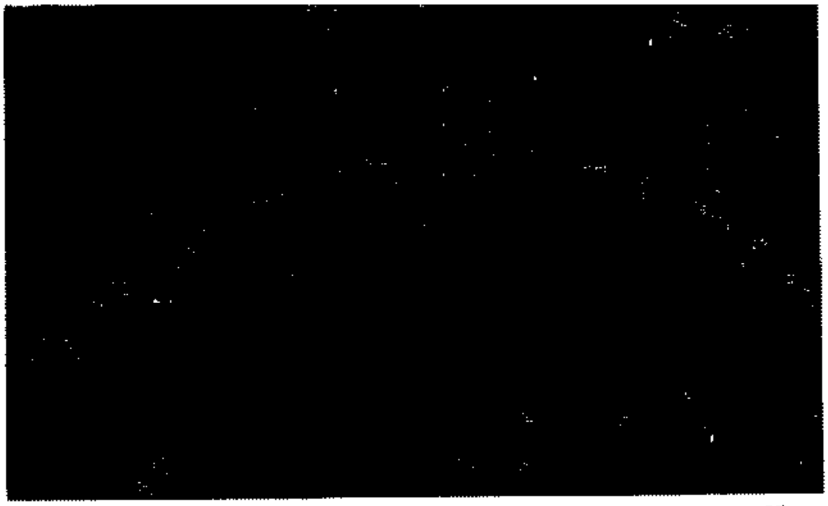

Fig. 3 25 ×

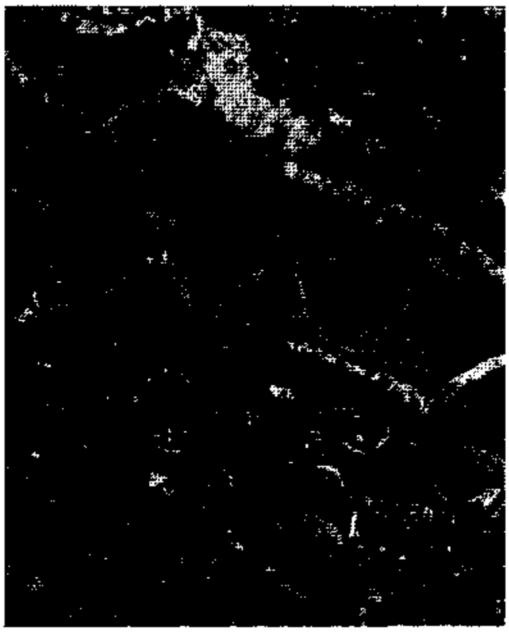

Fig. 4 10 ×

Fig. 5 20 ×

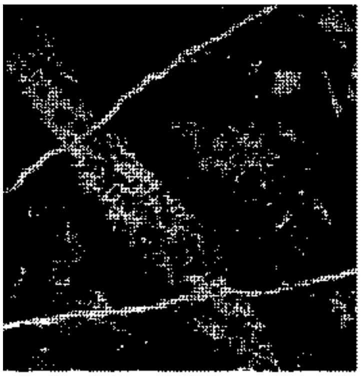

Fig. 1 20 ×

Fig. 2 20 ×

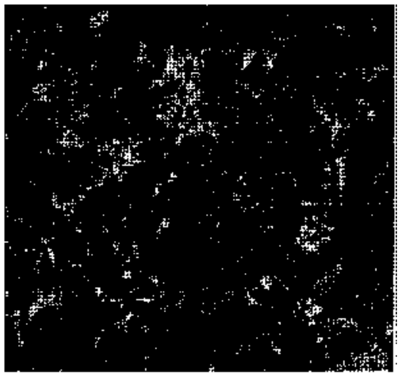

Fig. 3 20 ×

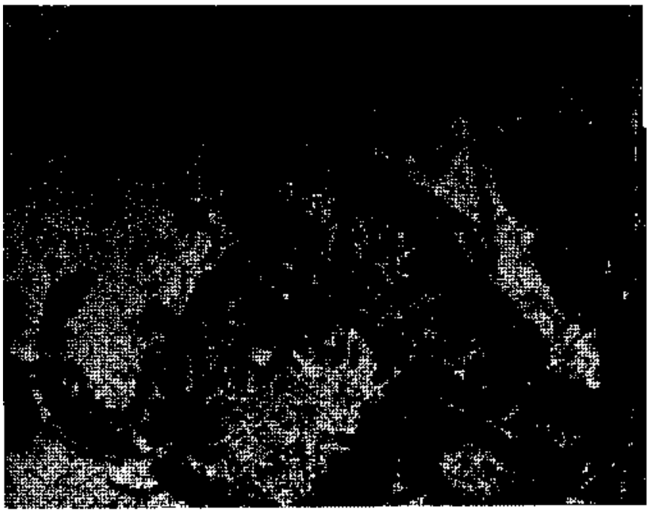

Fig. 4 20 ×

Fig. 5 20 ×

Fig. 6 20 ×

Fig. 7 20 ×

Fig. 8 40 ×

Fig. 9 40 ×

Fig. 1 40 ×

Fig. 2 40 ×

a.....

.....b

Fig. 3 40 ×

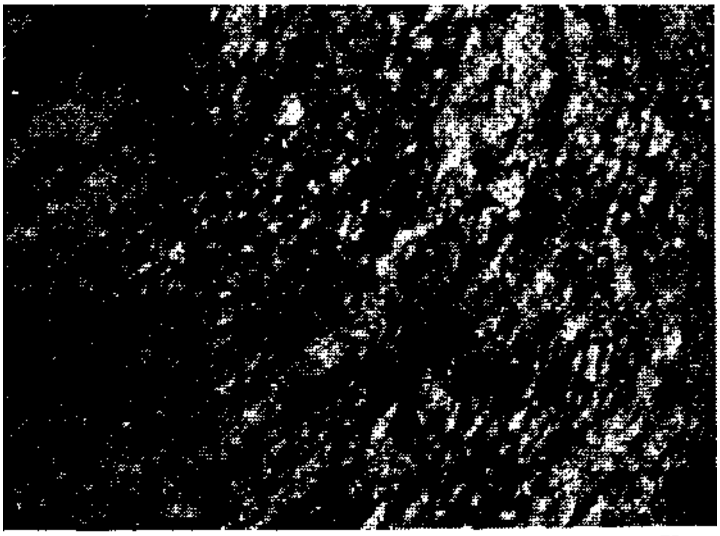

Fig. 1 59 ×

Fig. 2 40 ×

Fig. 3 40 ×

Fig. 4 40 ×

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