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POROSTROMATA ALGAE FROM THE BURDIGALIAN LIMESTONE OF KACHCHH, GUJARAT, INDIA

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ABSTRACT

Calcareous porostromata algae belonging to the family Rivulariaceae are described here for the first time from the Burdigalian limestone of the Chhasra Formation of Kachchh, Gujarat, India. The present paper deals with the record of three species of *Rivularia*.

Keywords: Porostromata algae, *Rivularia*, Burdigalian limestone, Kachchh

INTRODUCTION

The porostromata algae belonging to the division Cyanophyta were described earlier by Pia (1927), Johnson (1961), Monty (1967), Riding (1975, 1977), Dragastan (1993) and Ghosh and Maithy (1995). They described the morphology, shape, tubiform structure, filamentous shape and calcification processes in porostromata algae. Dragastan (1993) gave the systematic classification of the porostromata algae on the basis of structure.

So far forms belonging to the porostromata algae from Kachchh district have not been described earlier. They are described here for the first time from the Burdigalian of Kachchh, Gujarat, India.

GEOLOGICAL SETTING AND PREVIOUS WORK

The sedimentary rocks of western part of the Kachchh district range from Paleocene to Pliocene. These have been studied by Biswas (1965, 1971, 1972 and 1992), Biswas and Deshpande (1970), Biswas and Raju (1971, 1973) and Tondon (1974). The stratigraphic classification of sediments of the western Kachchh proposed by Biswas (1992) is adopted in the present paper.

Biswas (1992) classified the rocks of western Kachchh into eight formations such as the Matanomadh (Paleocene), the Naredi (Upper Paleocene to Lower Eocene), the Harudi (Early Middle Eocene), the Fulra Limestone (Late Middle Eocene), the Maniyara Fort (Oligocene), the Khari Nadi (Early Lower Miocene), the Chhasra (Late Lower Miocene / Burdigalian) and the Sandhan (Middle Miocene to Pliocene) (Fig. 1, Table 1).

The present paper deals with the three species of the genus *Rivularia* such as *Rivularia lissaviensis, R. dianae* and *Rivularia* sp. of porostromata algae belonging to the family Rivulariaceae. These species are recovered from the limestone of the Chhasra Formation (Burdigalian) of western Kachchh.

Prior to 1979 only 9 coralline algae from Cenozoic rocks of the Kachchh district of Gujarat were reported (Pal and Ghosh, 1974; Tondon et al., 1978 and Kar, 1979). Since 1979 many workers have reported more than 76 species of the calcareous algae from the rocks of the Fulra Limestone Formation, the Maniyara Fort Formation, the Khari Nadi Formation and the Chhasra Formation (Misra et al., 2001; Singh and Kishore, 2001; Singh et al., 2002; Ghosh, 2002, Humane and Kundal, 2004, 2005, 2006 and Kundal and Humane, 2002, 2003, 2005, 2006a, 2006b, 2006c, 2006d).

MATERIALS AND METHOD

The present study is based on over 100 limestone samples collected from the few localities of the Chhasra Formation around Chhasra Stream Section (Fig. 2a), Ramwada Mandir Section (Fig. 2b) and Rampar Canal Section (Fig. 2c) of the western Kachchh district, Gujarat. Lithologically these limestone are yellowish in colour. Thin sections of the limestone recovered from these ar-

Table 1: Stratigraphic classification of Tertiary sediments of Kachchh, Gujarat (after Biswas, 1992).

TIME IN M.Y.	SERIES		STAGE	LITHOSTRATIGRAPHY FORMATION	MEMBER	FORMAINIFERAL ZONE
	PLIOCENE		5.2			
10	MIOCENE	UPPER	MESSINIAN 6.3 TORTONIAN 10.2	SANDHAN		To be Zoned
		MIDDLE	SERRAVALLIAN 15.2			
			LANGHIAN 16.2			
20		LOWER	BURDIGALIAN 20	CHHASRA	SILTSTONE CLAYSTONE	*A. papillosus* *M. (L.) excentrica* *M. (L.) droogeri* *M. globlina-thecidea stormis*
			AQUITANIAN 25.2	KHARI NADI		*M. (M.) tani* Poorly Fossiliferous
30	OLIGOCENE	UPPER	CHATTIAN 30	MANIYARA FORT	BERMOTI	*M. (M.) complanata formosensis* *M. (M.) bermudezi* *P. freudenthali*
		LOWER	RUPELIAN 36		CORAL LIMESTONE LUMPY CLAY BASAL MEMBER	*N. fichteli/E. dialata* *N. fichteli*
40	EOCENE	UPPER	PRIABONIAN 39.4			
		MIDDLE	BARTONIAN 42	FULRA LIMESTONE		*T. rohri* *O. beckmanni*
			LUTETIAN 49	HARUDI		*T. topilensis* *N. optusus*
50		LOWER	YPRESIAN 54	NAREDI	FERR. CLAYSTONE *ASSILINA* LIMESTONE GYPSEOUS SHALE	Poorly Fossiliferous *A. granulosa* *A. spinosa* Ostracod Zone
60	PALEOCENE	UPPER	THANETIAN 60.2	MATANOMADH		
		LOWER	DANIAN 66.5	DECCAN TRAP		
70	CRET	UPPER	MAASTRICHTIAN			

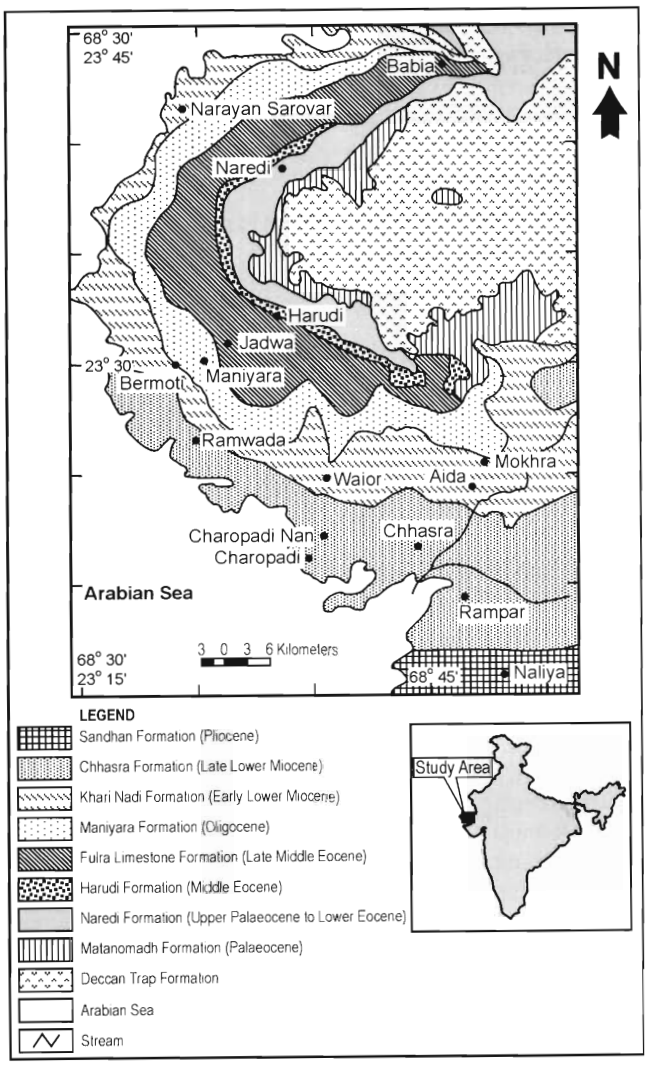


Fig. 1. Geological map of western Kachchh, Gujarat (after, Biaswas, 1992).

eas were prepared by grounding method.

All the specimens and slides are kept in the Micropalaeontology Laboratory of the Postgraduate Department of Geology, R. T. M. Nagpur University, Nagpur.

SYSTEMATIC DESCRIPTION

The systematic classification of porostromata algae followed in the present paper is adopted after Dragastan (1993).

Division **Cyanophyta**

Order **Nostocales**

Family **Rivulariaceae** Rabenhorst 1865

Genus ***Rivularia*** (Roth) Agardh 1824

Rivularia lissaviensis (Bornemann, 1887) Dragastan, 1985
(Pl. I, figs. 1-3, 6)

Rivularia lissaviensis Bornemann, 1887, Dragastan, 1985, p.106-110, pls. 1, 3-8. Ghosh and Maithy, 1995, p. 50, pl. 1, fig. 6.

Material: PGTDG / MF / R / 1, 2, 3

Description: Thallus is 'V' shaped with pseudobifurcated filaments and traces of heterocyst (arrows). The cross sections show clearly visible growth zones. Thallus is 625 to 1000 µm wide and diameter of filaments at the base ranges between 12 to 25 µm. The divergence angle is 10° (Pl. I, figs. 1-3, 6).

Remarks: Dragastan (1985) described morphology of thallus of *Rivularia lissaviensis*.

Rivularia dianae (Dragastan and Bucur, 1978)
Dragastan, 1985
(Pl. 1, figs. 4, 5)

Rivularia dianae Dragastan and Bucur, 1978, Dragastan, 1985, p. 114-115, pl. 15, figs. 2-3.

Material: PGTDG / MF / R / 4, 5

Description: Thallus shows calcified 'V' shaped filaments. Thallus is 235 µm wide and 263 µm in height. Filaments are preserved with sheath, lumen and growth zones. The diameter of microcrystalline lumen of the filament ranges between 6 to 9 µm. Angle of divergence of filaments is about 4° to 6° (Pl. I, figs. 4, 5).

Remarks: The present algal forms are closely resembling with the filaments of *Rivularia dianae* Dragastan described from the Tithonian, Piatra Craiului, East Carpathians.

Rivularia sp.
(Pl. I, figs. 7, 8)

Material: PGTDG / MF / R / 7, 8

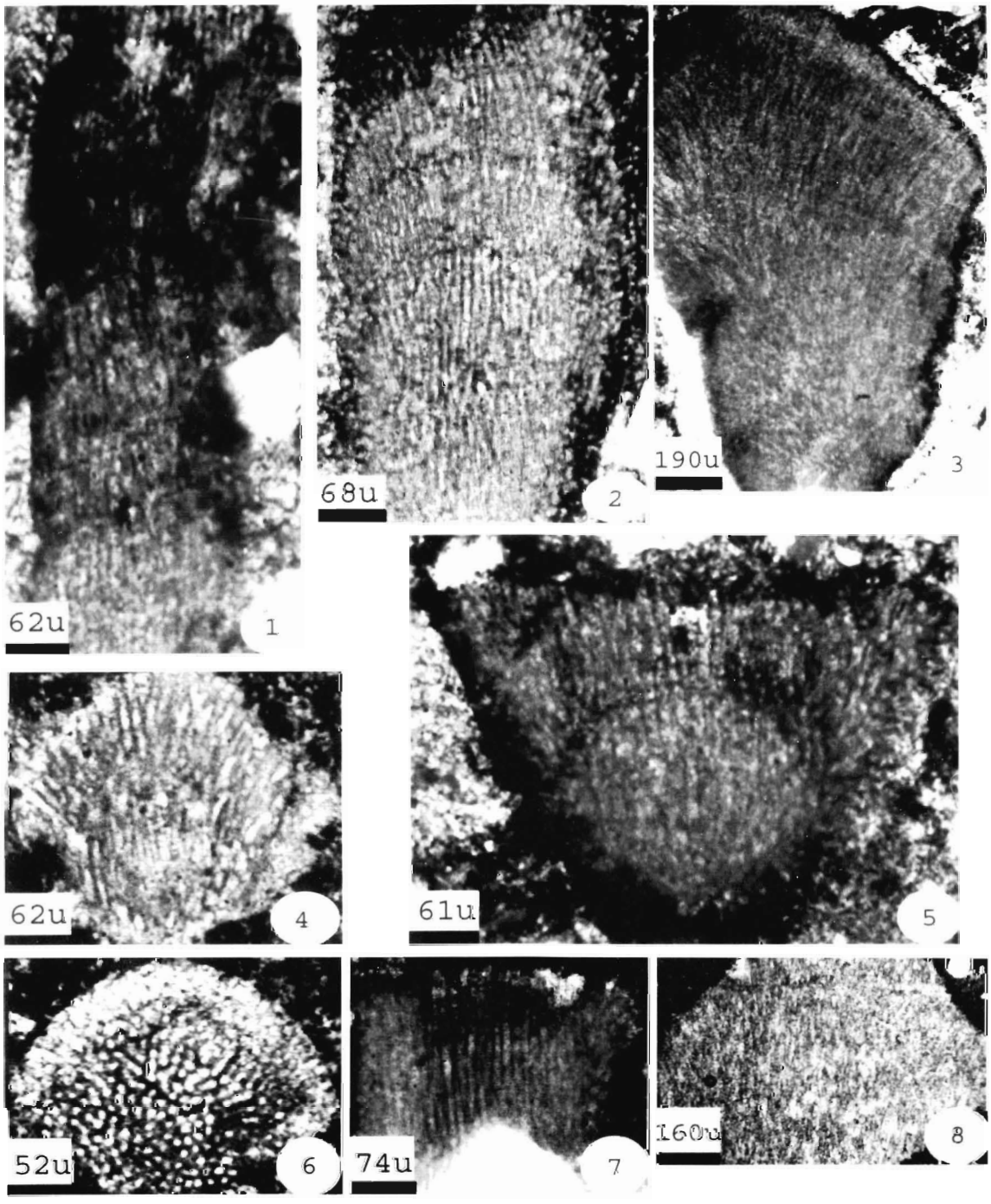
Description: Thallus is simple. It shows plane of pseudobifurcation. Filaments preserved with sheath and meristematic cells are visible. The width of the thallus is 250 to 1050 µm and 875 µm in height (Pl. 1, Fig. 8)

Remarks: The present material is limited in numbers

EXPLANATION OF PLATE I

1. ***Rivularia lissaviensis*** (Bornemann, 1887) Dragastan (1985) showing various morphology of thallus. Thallus shows 'V' shaped filaments.
   Specimen number PGTDG/NU/R/ 1
2. ***Rivularia lissaviensis*** (Bornemann, 1887) Dragastan (1985) showing 'V' shaped thallus and growth zones, pyriform heterocyst and meristematic zones.
   Specimen number PGTDG/NU/R/ 2
3. ***Rivularia lissaviensis*** (Bornemann, 1887) Dragastan (1985) showing traces of Heterocyst, growth zone is visible.
   Specimen number PGTDG/NU/R/ 3
4. ***Rivularia dianae*** Dragastan and Bucur (non, 1978) Dragastan (1985) showing filaments preserved with sheath, lumen and growth zones.
   Specimen number PGTDG/NU/R/ 4
5. ***Rivularia dianae*** (Dragastan and Bucur , 1978) Dragastan (1985) showing filaments preserved with microcrystalline lumen and inner surface of sheath, micrograined calcite in outer surface of sheath, plane of pseudobifurcation.
   Specimen number PGTDG/NU/R/ 5
6. ***Rivularia lissaviensis*** (Bornemann, 1887) Dragastan (1985). Thallus is fan like, compact, zoned and pseudobifurcated.
   Specimen number PGTDG/NU/R/ 6
7. ***Rivularia*** sp. showing the 'V' shaped filaments, growth zones and heterocyst.
   Specimen number PGTDG/NU/R/ 7
8. ***Rivularia*** sp. showing simple thallus and growth zones.
   Specimen number PGTDG/NU/R/ 8

Plate I



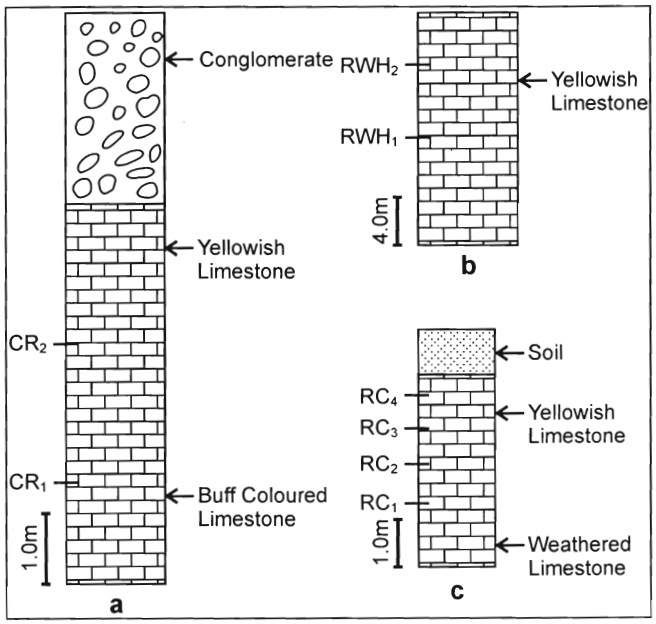


Fig. 2. Lithosections of the Chhasra Formation at
a) Chhasra Stream Section, b) Ramwada Mandir Section and c) Rampar Canal Section.

therefore we have kept this algal species in open nomenclature as *Rivularia* sp.

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