STROMATOLITES IN THE PROTEROZOIC DUCK CREEK DOLOMITE WESTERN AUSTRALIA

by Kathleen Grey

ABSTRACT

Stromatolites are abundant in the 2.0 Ga Duck Creek Dolomite, Wyloo Group, Western Australia, although the taxonomic diversity is low. Upward-shallowing sequences occur in the lower part of the dolomite and contain a new form, *Asperia ashburtonia*, in addition to *Pilbaria perplexa* Walter 1972 and *P.* cf. *perplexa*, as well as domical and stratiform stromatolites not given taxonomic status. Each distinct taxa or morphology characterizes a particular facies in the upward-shallowing sequences. An exhaustive summary of the occurrences of stromatolites in the lower part of the dolomite is given.

Stromatolites in the upper part of the Duck Creek Dolomite are less well known and further systematic studies are required. However, the taxa which occur are different from those in the upward-shallowing sequences.

INTRODUCTION

During re-mapping of the Wyloo 1:250 000 sheet (Seymour and others, in prep.), several stromatolitic dolomite samples from the Wyloo Group were collected for identification and palaeoenvironmental intrepretation. Some of these samples consisted of a new form which apparently occurred together with a previously described form in repeated sedimentary sequences. A more comprehensive sampling programme was initiated to obtain additional material and to investigate the possible relationships between stromatolite taxa and environment of deposition.

Stromatolites are abundant in the Duck Creek Dolomite, but few forms are represented. They were first reported from the Wyloo Group by Halligan & Daniels (1964) and Edgell (1964), but the first major systematic study was that by Walter (1972). He described *Pilbara perplexa, Patomia* f. indet.; and an "Unnamed Stromatolite" that was previously incorrectly identified as *Collenia australasica* (Howchin) by Edgell (1964). Another new form, *Asperia ashburtonia,* is described below, and the distribution of stromatolite taxa is documented.

GEOLOGICAL SETTING AND AGE

The Duck Creek Dolomite, a unit in the upper part of the Wyloo Group, crops out extensively (Fig. 1) in the Western Pilbara (Halligan & Daniels, 1964; Trendall, 1975). It conformably overlies the Mount McGrath Formation, and is overlain by June Hill Volcanics or the Ashburton Formation. It is over 1 000 m thick, but stromatolites occur mainly in the lower 300 m. Thorne (1985) carried out a Markhov Chain analyses on the lower 220 m of the dolomite, where it is well exposed in Duck Creek Gorge (Fig. 1), and recognized nine major sedimentary facies. The facies occur in repeated upward-shallowing sequences, and the distribution of stromatolite taxa is closely linked to the type of facies (Grey & Thorne, in prep).

The precise age of the Duck Creek Dolomite is not known, but Gee (1980, Fig. 1) favoured an age of approximately 2.0 Ga, and suggested correlation with the Glengarry Group in the western part of the Nabberu Basin. Clasts from the Woongarra Volcanics (in the underlying Mount Bruce Supergroup) occur at the base of the Wyloo Group and provide a lower age limit, based on a U-Pb zircon age of 2 470± 30 Ma (Compston and others, 1981). West of Mount Stuart (outside the area shown on the map) the overlying Ashburton Formation is intruded by the Boolaloo Granodiorite, for which Leggo and others (1965) obtained a Rb/Sr mineral isochron of 1.68 Ga. Rb/Sr whole-rock isochron dates from the Wyloo Group of *1 977 ±165 Ma from "acid igneous rock" (Compston and Arriens, 1968) and *1 811 Ma from "tuffaceous siltstone" (Leggo and others, 1965) are probably less reliable (Seymour, pers. comm. 1984) although they fall within the upper and lower limits referred to above.

STROMATOLITE OCCURRENCES

Localities referred to in the text below are listed in Table 1 and shown in Figure 1, and are identified by GSWA fossil locality numbers, in which the relevent 1:250 000 geological sheet is given a three-letter code,

*recalculated values using ^{87}Rb decay constant = $1.42 \times 10^{-11} a^{-1}$

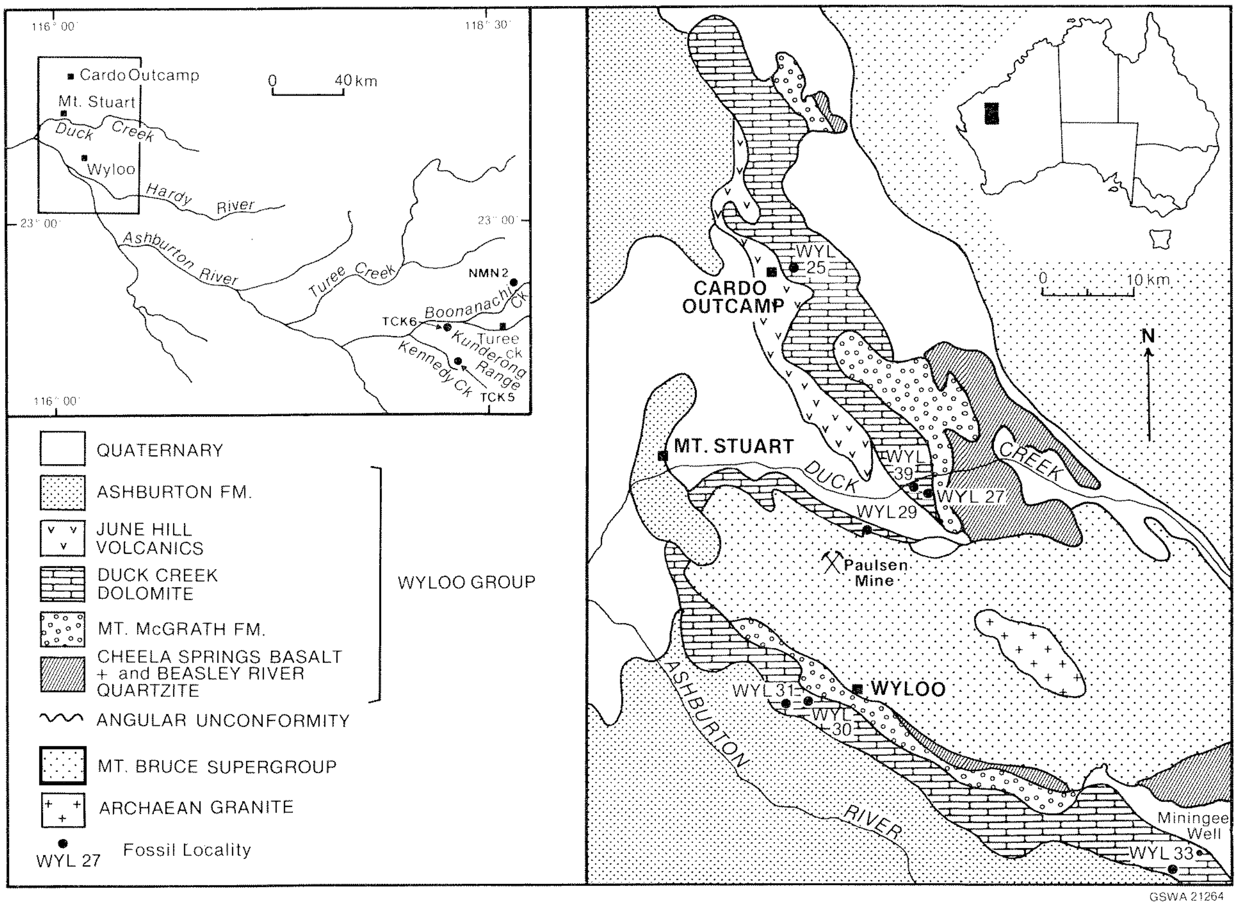


Figure 1. Part of the Western Pilbara, W.A., showing fossil localities referred to in the text, and a detailed geological sketch map of the Wyloo area.

e.g. WYL 31 for Wyloo, location 31. The fossils themselves (including holotypes) are stored either in the GSWA collection (prefix F) or in the Geology Department Collection, University of Adelaide (prefix S).

Pilbaria perplexa Walter 1972 and the new form *Asperia ashburtonia* both occur in the lower part of the Duck Creek Dolomite, in different facies of the upward-shallowing sequences. (Grey & Thorne, in prep.). *Patomia* f. indet. is known only as a single specimen, possibly from the upper part of the formation. Details are also given for other stromatolites not yet assigned to taxa, either because of poor preservation or lack of material.

Stromatolites in the lower part of the Duck Creek Dolomite are best exposed in the Duck Creek Gorge section (WYL 39 in Fig. 1). Thorne (1985) has logged in detail the lower 300 m of the section which contains the upward-shallowing sequences, and Grey and Thorne (in prep.) discuss the significance of the distribution of stromatolite taxa in the sequences described by Thorne (1985).

Upward-shallowing sequences are approximately 1.5 m thick in the lower part of the section, Sequence 1 of Thorne (1985), and consist of an erosively based grainstone, a nucleated-domical-stromatolite facies, a laminated-dolomite facies, and a mixed facies which includes tepees, disrupted domes, cuspate stromatolites, and low-domical stromatolites. The sequence is overlain by the next erosively based grainstone. Sequences in the upper part of the measured section are usually about 3 m thick; and, in the preferred sequence, Sequence 2 of Thorne (1985), the nucleated-domical-stromatolite facies is missing, and is replaced by a small, branching-columnar-stromatolite facies and a large, branching-columnar-stromatolite facies.

Of the stromatolites which occur in the gorge section, only three types have been accorded taxonomic status. These are *P. perplexa*, *P.* cf. *perplexa* and *A. ashburtonia*. Nucleated-domical stromatolites; oncolites, which occasionally occur in the grainstone facies, and stratiform stromatolites, which comprise much of the laminated-dolomite facies, do not have characteristics sufficiently distinctive for systematic treatment.

The low-domical stromatolites (Fig. 2) in the mixed facies consist of closely packed columns of *Asperia ashburtonia*, which, as discussed by Grey (1984) and Grey and Thorne (in prep.), most probably grew in subaerial conditions subject to intermittent periods of submergence, possibly seasonal in origin. This is consistent with the high-intertidal to supratidal environment postulated by Thorne (in prep) from the

TABLE 1. DETAILS OF STROMATOLITE LOCALITIES

Fossil locality number	*Sample No.*	*Identification*	*Locality description*	*Map*	*Latitude and longitude*
NMN 2	F 12754	New group and form (previously *Patomia* f. indet)	near Boonoonachi Creek 15km north northeast of Turee Creek homestead	Newman	23°28'15"S 118°37'11"E
TCK 5	F 8134	*Patomia* f. indet. (name requires revision)	(from Walter, 1972) "26 miles east-northeast of Mount Bresnahan"; near Kennedy Creek (locality position doubtful D. B. Seymour pers. comm., 1984)	Turee Creek	23°44'09"S 118°18'48"E
TCK 6	F 46625	unnamed form	3 km west of west end of Kunderong Range	Turee	23°35'37"S 118°26'10"E
WYL 25	F 46623 F 46624	*Pilbaria perplexa* *Asperia ashburtonia*	6.4 km east Cardo Outcamp	Wyloo	22°16'30"S 116°12'46"E
WYL 27	S 206	*Pilbaria perplexa* (holotype)	(from Walter, 1972) "20 miles east of Mount Stuart homestead . . . beside the track" (the track is an old one, about 2 km south of Duck Creek Gorge M. R. Walter, pers. comm., 1983)	Wyloo	22°29'07"S 116°20'04"E
WYL 29	F 46610 F 46611 F 46612 F 46613 F 46614 F 46620 F 46621	*Pilbaria perplexa* *Pilbaria perplexa* *Pilbaria perplexa* *Pilbaria perplexa* *Asperia ashburtonia* *Asperia ashburtonia* (holotype) *Asperia ashburtonia*	5 km north east of Paulsen mine	Wyloo	22°32'31"S 116°15'46"E
WYL 30	F 9980 F 46622	*Pilbaria perplexa* *Pilbaria perplexa*	(from Walter, 1972) "between Wyloo and the homestead" (The locality is in fact between Wyloo hst and the woolshed, 5.5 km south-west of Wyloo homestead)	Wyloo	22°43'45"S 116°11'13"E
WYL 31	—	*Pilbaria perplexa*	9.9 km west-southwest of Wyloo homestead	Wyloo	22°43'30"S 116°08'00"E
WYL 33	F 12519	unnamed columnar stromatolite	4.5 km southwest of Miningee Well	Wyloo	22°52'36"S 116°36'21"E
WYL 39	F 46615,16 F 46617,18 F 46619	*Pilbaria perplexa* *Asperia ashburtonia* *Pilbaria* cf. *perplexa*	Duck Creek Gorge	Wyloo	22°28'53"S 116°18'40"E

sedimentological evidence. Bioherms in the small branching-columnar-stromatolite facies are formed by *Pilbaria perplexa* (Fig. 3) which probably grew in shallow lagoons with rare periods of emergence (Grey and Thorne, in prep.) The large branching-columnar-stromatolite facies consists of *Pilbaria* cf. *perplexa* (Fig. 4), which most probably developed in a higher energy, intertidal environment. These conclusions, based on interpretation of stromatolite morphology (Grey and Thorne, in prep.) are consistent with Thorne's interpretaions based on sedimentological data.

Elsewhere in the Duck Creek Dolomite, upward-shallowing sequences are less readily recognizable because outcrop is poorer. Walter (1972) described *P. perplexa* (F 9980) from near Hardy Junction (Fig. 1, WYL 30). Preservation is poor, but *P. perplexa* can be recognized in outcrop. *A. ashburtonia* is absent. A large bioherm of *P. perplexa* crops out 4 km further west of the above locality (Fig. 1, WYL 31). Here, the rocks are steeply dipping and strongly cleaved. The stromatolite columns have been deformed (Fig. 5), and their cross-sections are oval. The laminations parallel to the direction of compression are steeply convex, and column interspaces are almost totally destroyed. *A. ashburtonia* is absent and the relationship of the bioherm to strata above and below cannot be determined.

At the type locality of *P. perplexa* (Fig. 1, WYL 27) Walter (1972) reported "tabular biostromes about 0.5 m thick and much thicker (several metres) beds of unknown shape". This mode of occurrence seems similar to the *P. perplexa* horizons in Duck Creek Gorge; however, he did not report any small, digitate stromatolites (here named *ashburtonia*) from this locality and the area was not visited during the present study.

GSWA 21265

Figure 2. Part of a low-domical bioherm consisting of closely packed, silicified columns of *Asperia ashburtonia* new form—Duck Creek Gorge, WYL 39.

GSWA 21266

Figure 3. Part of a column of *Pilbaria perplexa*, showing typical niche and pocket development. Polished slab of GSWA F 46610 —5 km north-east of Paulsen Mine, WYL 29.

At the type locality of *A. ashburtonia* (Fig. 1, WYL 29), the Duck Creek Dolomite overlies the Mount McGrath Formation, and is fault-bounded by the Brockman Iron Formation of the older Hamersley Group. Preservation of the stromatolites is particularly good and collecting is easy from the rubbly outcrop. *P. perplexa* is abundant at this locality, although only two horizons of *P. perplexa* separated by one of *Asperia ashburtonia* can be recognized. Flat-laminated dolomite layers also occur, but detailed sedimentological relationships cannot be determined because of the rubbly nature of the outcrop.

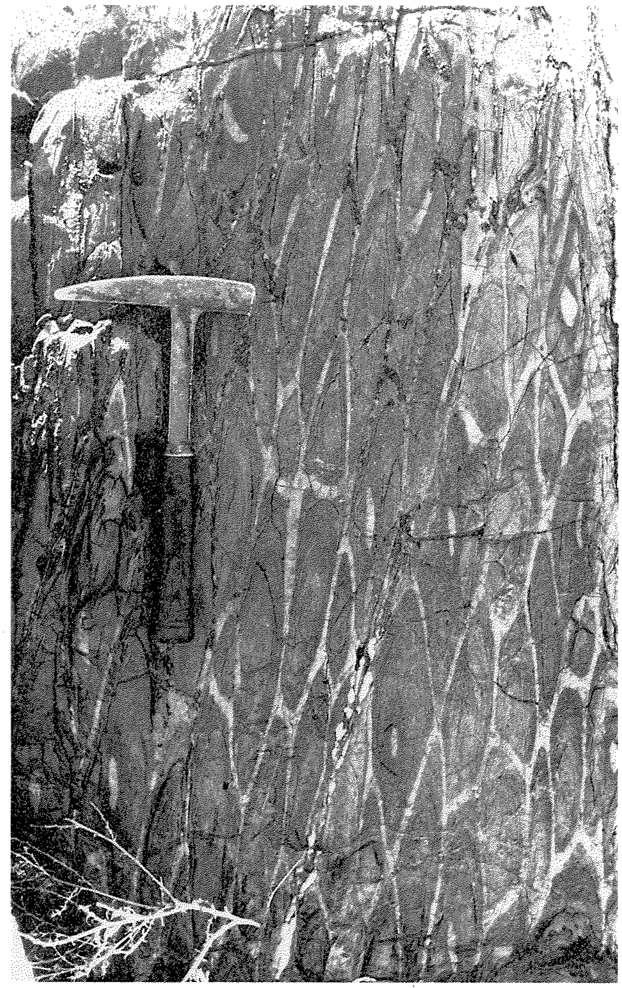
The Duck Creek Dolomite crops out patchily in a series of low ridges parallel to the track for about 2 km east of the *A. ashburtonia* type locality. *A. ashburtonia* does not occur, although *P. perplexa* is common at some outcrops, but is nowhere well exposed or well preserved. The "Unnamed Stromatolite" of Walter (1972, p. 177), which in this paper is placed in *P. perplexa*, was collected from somewhere near here, although the precise locality could not be relocated.

North of Duck Creek, well-preserved stromatolites occur at only one locality (Fig. 1, WYL 25), where poorly outcropping dolomite at the base of a ridge north of the track contains two *P. perplexa* horizons separated by an *A. ashburtonia* horizon. The stromatolites form a series of low benches; but because of the sporadic outcrop, the nature of the sediments separating the biostromes cannot be determined. Both stratiform and domical stromatolites are present, suggesting that the sequence, though not as extensively developed, is similar to the Duck Creek gorge section.

The stromatolite taxa which occur in the lower part of the Duck Creek Dolomite do not seem to be present in the upper part of the formation. Little is known about the distribution of stromatolites above the upward-shallowing sequences, and all of them require systematic study. Walter (1972) described *Patomia* f. indet. (F8134) probably from the upper part of the Duck Creek Dolomite (Fig. 1, TCK 5). He stressed the tentative basis on which the specimen was placed in *Patomia*. The degree of curvature of the laminae is more variable, the column margins are more ragged,

GSWA 21267

Figure 4. *Pilbaria perplexa* biostrome in the lagoonal facies, overlain by the larger, and more irregular, *Pilbaria* cf. *perplexa*. This in turn is succeeded by intertidal laminated dolomite facies —Duck Creek Gorge, WYL 39.



GSWA 21268

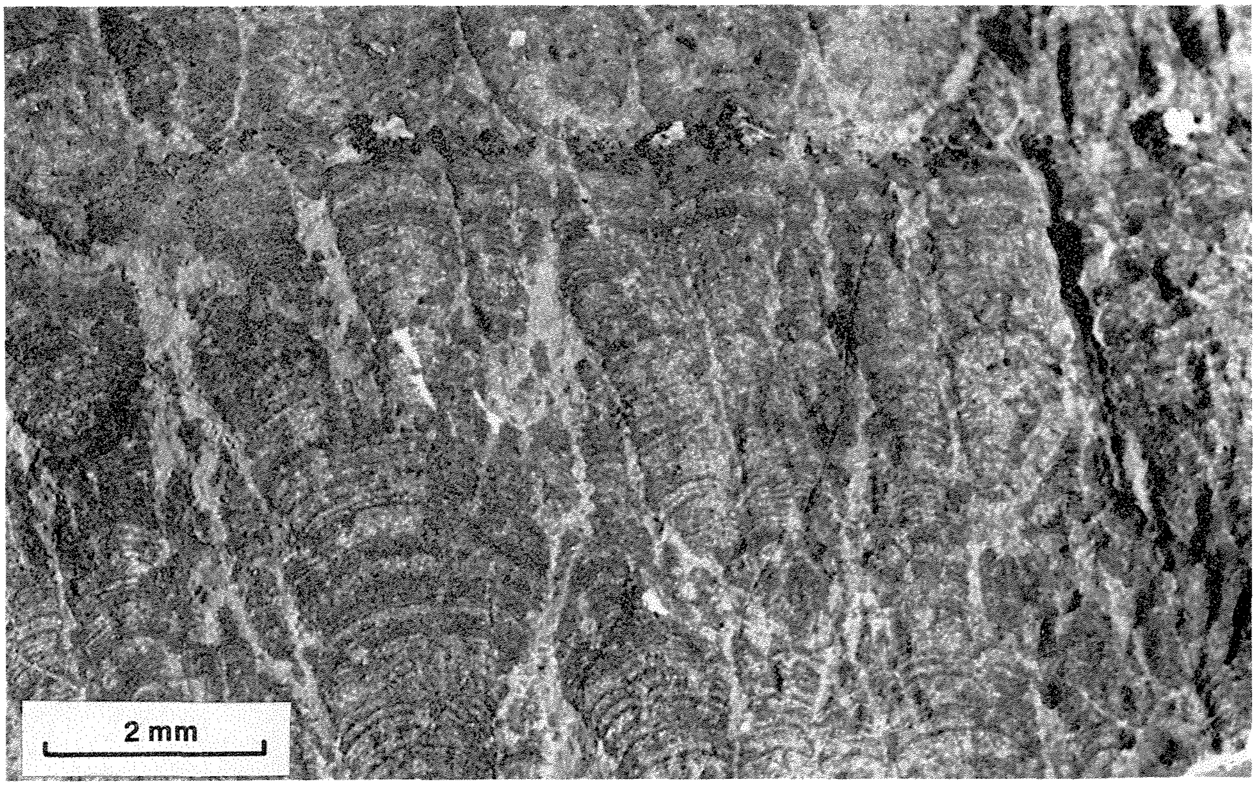
Figure 5. Deformed bioherm of *Pilbaria perplexa* showing tangential sections of columns. Note the reduced intercolumnar area —From 9.9 km west-south-west of Wyloo Homestead, WYL 31.

and the branching pattern more divergent than in *Patomia*. Some of the features of this specimen are also found in several groups erected since the publication of Walter's description. These include *Sundia* Butin 1966 and *Tibia* Bertrand-Safati and Eriksson 1977. Identification of the Duck Creek Dolomite form is not possible until better preserved material is available; however, only laminated stromatolitic dolomite has since been found at the reported locality (D. B. Seymour pers. comm. 1984).

Other stromatolite localities have been recorded from the (possibly) upper Duck Creek Dolomite (Walter, 1972; Grey, 1979), but many remain unsampled. Three have been the subject of unpublished reports (Grey, 1981 a, b, c) but none of the stromatolites can be placed in existing taxa. A small fragment (F 12519) from one locality (Fig. 1, WYL 33), resembles undescribed and poorly preserved stromatolites from the Glengarry Group (Grey, 1981a). A second (Fig. 1, NMN 2) was at first (Grey, 1981b) placed in *Patomia* f. indet. on the basis of one small sample (F 12754). Additional material suggests that the stromatolite belongs to a new group and form that are awaiting description. The stratigraphic position of the dolomite unit is uncertain. It may be Duck Creek Dolomite or possibly Mount McGrath Formation, but it could also belong to the Turee Creek Group. The third stromatolite (Grey, 1981c, F 46625) is also from a unit of uncertain stratigraphic position (Fig. 1, TCK 6). It is a small digitate form, still awaiting description, but differs in several respects from *Asperia ashburtonia*. Studies are continuing on all three stromatolites.

CONCLUSIONS

This study has shown that stromatolites in the Duck Creek Dolomite are restricted to relatively few taxa. *Pilbaria perplexa*, *Pilbaria* cf. *perplexa* and *Asperia ashburtonia* are common in the lower part, where upward-shallowing sequences are well developed (Thorne, 1985). The relationship between the distribution of stromatolite taxa and sedimentary environment can best be studied in the well-exposed



GSWA 21269

Figure 6. Weathered surface of *Asperia ashburtonia* showing branching pattern and banded lamination—From 5 km north-east of Paulsen mine, WYL 29.

section in Duck Creek Gorge. Here it can be shown that each of the three taxa is restricted to a specific facies (Grey and Thorne, in prep). Elsewhere the association between stromatolite taxa and depositional environment cannot be as clearly shown. *P. perplexa* has been reported from more localities than the other two taxa, but this could, in part, be due to problems of recognition in the field, particularly in the case of *A. aspera*. Stromatolites belonging to different taxa occur in the upper part of the Duck Creek Dolomite, but are poorly known.

If the rather dubious identification of the middle to late Proterozoic group *Patomia* is discounted, as discussed above, the occurrence of the other taxa is consistent with known time distributions overseas (Grey, 1984; Grey and Thorne, in prep.). In particular *P. perplexa* and *Asperia* indicate an early Proterozoic age of between about 1.8 and 2.1 Ga.

SYSTEMATIC DESCRIPTIONS

Asperia Semikhatov 1978

Type form

Asperia aspera Semikhatov 1978, Rocknest Formation (Unit 8), Epworth Group, Asiak River Basin, Canadian Shield.

Diagnosis

"Small (usual diameter 3-8 mm, usual height 10-30 mm), tightly contiguous, digitate, subcylindrical, branching and coalescing wall-less columns, associated in massive segments by somewhat partial transitional bridges and (or) covered by relatively thick (several millimetres) extended bundles of finely crimped laminae. Branching is frequent, by means of single successive breakup of the mother column into subparallel or very gently divergent thinner columns (passive branching), lateral surface with fine wrinkles and cornices. Good inheritance of lamination" (Translated from Semikhatov, 1978, p. 120-121).

Content

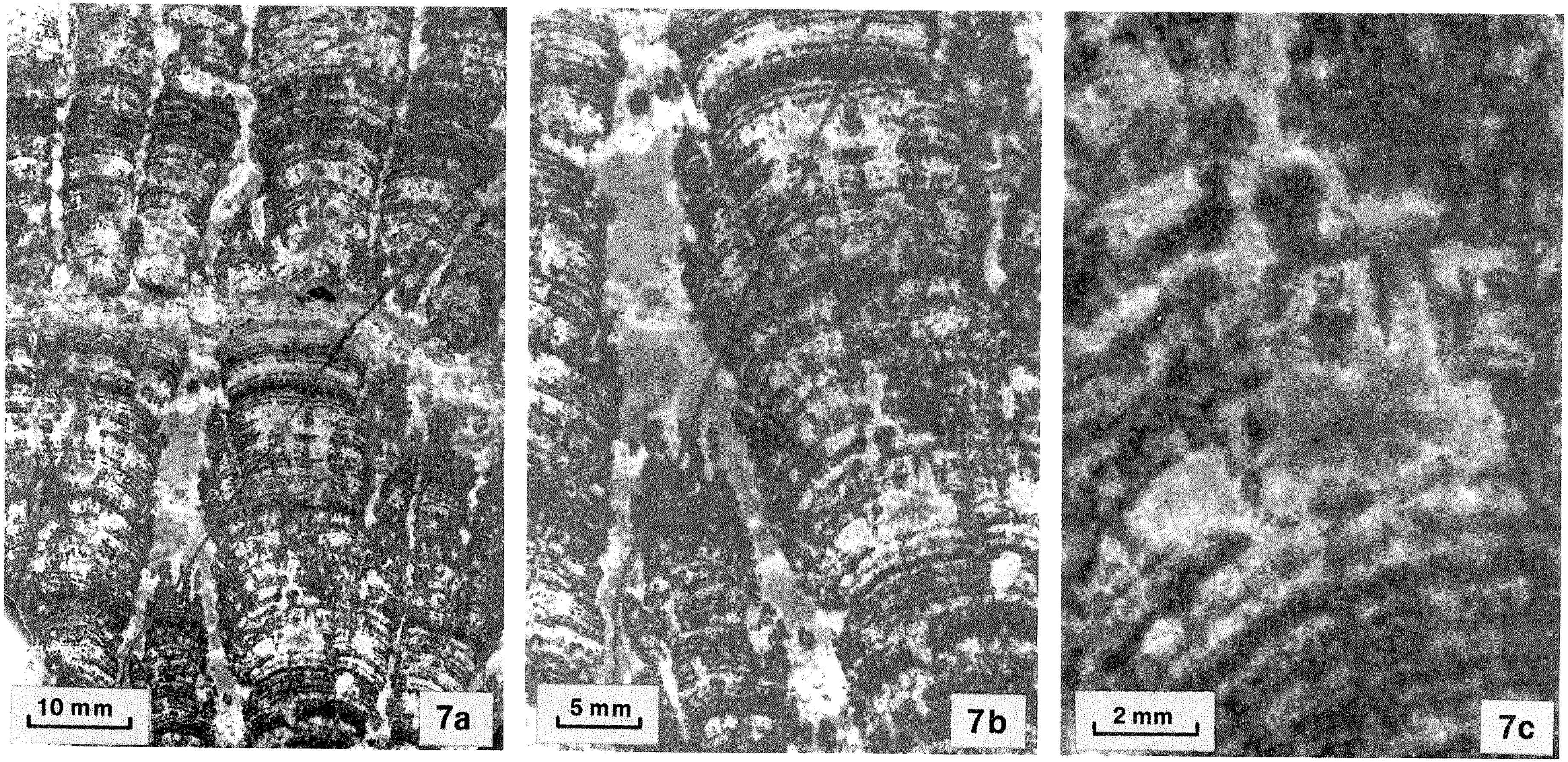
Asperia aspera Semikhatov 1978. *Asperia ashburtonia* form nov.

Remarks

Semikhatov (1978, p. 120) placed the small digitate stromatolites reported (but not formally described) by Donaldson (1963) into synonomy with *Asperia*, and also indicated that forms from Canada (Belcher Group) and Afghansistan should be placed in *Asperia*. However, none of these stromatolites have been described at form level; and, while there is considerable justification for assigning many of the informally documented occurrences listed in Table 2 to the group *Asperia*, this should only be done as part of a thorough systematic study.

Distribution and age

Rocknest Formation, Epworth Group, Great Slave Lake area, northern Canada, age approximately 1.9 Ga; Duck Creek Dolomite, Wyloo Group, western Pilbara, Western Australia age approximately 2.0 Ga.



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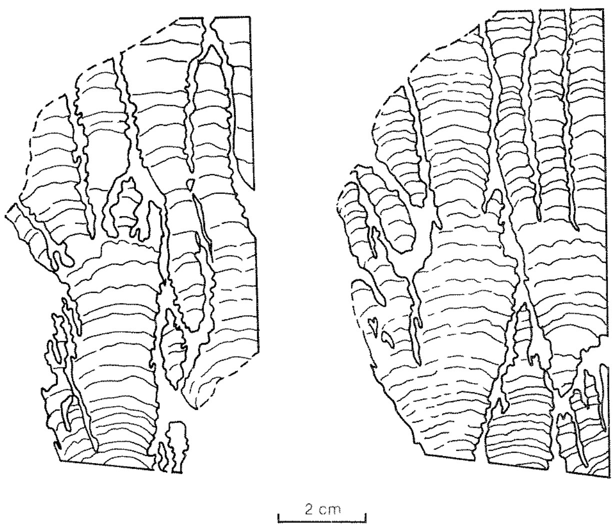

Figure 8. Holotype of *Asperia ashburtonia* new form, GSWA F 46620; laminae profiles drawn from polished slabs.

Asperia ashburtonia new form

(Figs 2, 6-8)

Material

Holotype: GSWA F 46620, from WYL 29 (Fig. 1)

Paratypes: F 46614 from the type locality, F 46617 and F 46618 from WYL 39, F 46624 from WYL 25, all from Wyloo 1:250 000 scale map area (Fig. 1).

Derivation of name

From the Ashburton River near the type locality.

Diagnosis

Branching, columnar stromatolites form large domes without well-defined fascicles (Grey, 1984), with erect, slender, subparallel to slightly divergent, closely spaced columns and beta-style branching. Columns arise from a stratiform base. Branching into two, three, or often more, columns of equal width is common. Some columns show a gradual upwards increase in width. Laterally occurring daughter columns are occasionally present. Walls are not developed. Column margins vary from scalloped to smooth, Laminae are flat to very gently convex and smoothly curved. Slight flexures appear prior to branching. Microstructure is distinctly banded; laminae of similar fabric and comparative thicknesses occur in adjacent columns.

Description

Outcrops: The type locality and other outcrops are described in the section of this paper dealing with the Duck Creek Dolomite. The base of the *Asperia ashburtonia* horizon at the type locality is poorly exposed. Columns develop directly from a stratiform horizon and form large contiguous bioherms up to 1 m in diameter. Tops of bioherms are eroded.

Mode of occurrence: Bioherms are domical, formed from closely-packed columns arising from a basal layer of stratiform laminae. Bioherms are approximately 30 cm high, and show very little variation throughout.

Branching habit: Branching is multifurcate, or occasionally bifurcate. Daughter columns are of equal width; they may gradually widen or taper upwards. Adjacent branches sometimes interfere with the growth pattern of one another. In general, branches are divergent, but where they are closely spaced, columns are usually parallel. Column interspaces are of more or less uniform width (1 to 3 mm).

Column shape and margin structure: Individual columns are usually cylindrical, but many widen gradually and in some cases, double in width in about 10 mm of height. Columns rounded to lobate in cross-section. Columns slender, erect and only rarely constringed. Wall is not present. Column margins are smooth to irregular with a scalloped appearance. Bridging occurs rarely. Columns vary in height, but many are up to 20 cm. Diameters vary from 10 to 15 cm.

Lamina shape: Lamina profiles are smooth and gently convex, with slight development of flexures before branching. Individual laminae can be traced as distinctive horizons across many adjacent columns. The serial development of laminae shows a high degree of inheritance.

Microstructure and texture: Microstructure and texture are distinctly banded with well-defined light and dark laminae. Individual laminae are of constant thickness across the column width, but the thickness of successive laminae varies considerably from only a few micrometres up to 3 mm. A secondary banding pattern, in which macrobands, 1 to 2 mm thick, consist of finer laminations, can usually be detected. The overall colour of the macrolaminae is determined by the thickness of the component microlaminae. Thickness of microlaminae is difficult to determine because of poor preservation. Both light and dark laminae are approximately 250 µm thick. Light laminae are homogeneous throughout, but dark laminae show a gradation in colour intensity from relatively light at the base to almost opaque at the top. The upper boundary is usually well defined, but where recrystallization has disrupted the laminae, micro-flaring occurs, giving the boundary a ragged appearance.

The original nature of the microstructure cannot be determined because of recrystallization. Grains are approximately 250 µm in diameter and equigranular.

Interspace filling: Interspaces are filled with micritic dolomite. Laminations cannot be recognized in the interspace fillings. Details of microstructure have been destroyed by recrystallization.

Secondary alteration: Extensive recrystallization and dolomitization has altered much of the original fabric. Only a coarse mosaic of secondary grains is present. At Duck Creek Gorge secondary silicification has been widespread. Interspace areas have been replaced by a coarse mosaic of quartz crystals. Extensive silicified patches occur in the columns, often destroying laminations.

Comparisons

Both *Asperia ashburtonia* and *Asperia aspera* Semikhatov 1978 are very similar in shape and fabric, and show a wide diversity in morphology. Features characteristic of one form may occasionally be present in the other. The principal differences are that the laminae in *Aperia aspera* are flatter and more wrinkled than in

Figure 7. A.—Holotype of *Asperia ashburtonia* new form, GSWA F 46620. Polished slab showing branching pattern and lamination—From 5 km north-east of Paulsen mine, WYL 29.

B—Detail of part of Fig. 7A showing banded microstructure.

C—Detail of part of Fig. 7B showing microstructure and effect of recrystallization.

Asperia ashburtonia, and are slightly more complex because of the development of double-layered dark laminae (Semikhatov, 1978, Pl.XIII, Fig. 2). Branching is more frequent in *A. ashburtonia*, and is more commonly multifurcate. These differences are relatively minor ones, and it may be that the two forms are synonymous. It will probably be necessary to resort to statistical methods (Hofmann, 1977) to confirm that the forms can be differentiated. However, from non-morphometric comparisons of type material, the distinctions appear to be valid.

A. ashburtonia differs from the digitate stromatolites in the Denault Formation (Donaldson, 1963; Semikhatov, 1978) in having multifurcate (rather than bifurcate) branching, flatter lamitations and broader columns. Anastomosing of columns is common. The columns of digitate stromatolites from the Belcher Group (Hofmann, 1977; Semikhatov, 1978) are shorter and stubbier than those in *A. ashburtonia*. In the Hornby Bay Group (Baragar and Donaldson, 1974) the digitate stromatolites have much narrower columns with very irregular margins, and more frequent and abundant branching than in *A. ashburtonia*.

In *Yelma digitata* Grey (1984), the columns are narrower and linked together in fascicles. Branching in *Y. digitata* is sometimes more widely divergent than in *A. ashburtonia*. Laminae in *Y. digitata* are thicker, less constant in thickness, and they are of three kinds, rather than two as in *A. ashburtonia*.

Katernia africana Cloud & Semikhatov 1969 and *Katernia perlina* Bertrand-Sarfati & Eriksson 1977 both have more divergent branching than *A. ashburtonia*, and their microstructure is filmy rather than banded. *Lenia jacutica* Dolnik (in Dolnik and Vorontsova 1971) has bifurcating and lateral branching, rather than multifurcate branching, and has more irregular columns.

Remarks

The small columns and close spacing make serial reconstruction of *A. ashburtonia* difficult, and only laminae tracings (Fig. 10) are shown. Visual comparison of digitate stromatolites is obviously a very subjective method, and in order to delimit the subtle differences which occur between forms, it will be necessary to resort to statistical methods. Hofmann (1977) described a computer assisted method of morphometric analysis which he applied to the digitate stromatolites from the McLeary formation (Hofmann assigned these to *Lenia* f.). The methods involved are relatively sophisticated, but would probably provide a suitable means for distinguishing between the various asperiform stromatolites in future studies.

Distribution and age

Duck Creek Dolomite, Wyloo Group, Western Australia, age approximately 2.0 Ga.

Pilbaria Walter 1972

Type form

Pilbaria perplexa Walter 1972, Duck Creek Dolomite, Wyloo Group, western Pilbara, Western Australia.

Diagnosis

As in Walter, 1972, p. 167.

Content

Pilbaria perplexa Walter 1972, *Pilbara boetsapia* and *Pilbaria inzeriaformis* Bertrand-Sarfati and Ericksson 1977, *Pilbaria deverella* Grey 1984, *Pilbaria* cf. *perplexa* Walter in Zhu Shixing (1982), cf. *Pilbaria perplexa* Walter in Crick & others (1980).

Distribution and age

Duck Creek Dolomite, Wyloo Group, Western Australia, age approximately 2.0 Ga; Schmidtsdrift Formation, Transvaal Group, South Africa, age approximately 2.2 Ga or older; Koolpin Formation, Pine Creek Geosyncline, central Australia, age between 2.0 to 2.3 Ga; Rocknest Formation, Epworth Group, Great Slave Lake area, northern Canada, age approximately 1.9 Ga; Assemblage 2, Hutuo Group, China, age approximately 1.9 Ga; Earaheedy Group, Nabberu Basin, Western Australia, age approximately 1.7 Ga.

Pilbaria perplexa Walter 1972

(Figs. 3, 4, 5)

1964, *Collenia australasica* Edgell, p. 244, Pl. 5.

1972, *Pilbaria perplexa* Walter, p. 167, Pl. 4, Fig. 4, Pl. 29, Figs 2-7.

1972, Unnamed stromatolite Walter, p. 177, Pl. 28, Fig. 4.

1978, *Pilbaria perplexa* Walter; Semikhatov, p. 141, Pl. XXIII, Figs. 1-3.

Type specimen

S206, Department of Geology and Mineralogy, University of Adelaide, South Australia. Duck Creek Dolomite (WYL 27, Fig 1).

Diagnosis

As in Walter 1972, p. 167.

Remarks

From examination of the sample (F 5015) referred to as "Unnamed Stromatolite" by Walter (1972), and comparison with material in outcrop, the poorly preserved columns are within the range of diversity shown by *Pilbaria perplexa* and consist of the small, uppermost parts of *P. perplexa* columns.

Distribution

Duck Creek Dolomite, Wyloo Group, Western Australia, age approximately 2.0 Ga. Rocknest Formation, Epworth Group, Great Slave area, northern Canada, age approximately 1.9 Ga.

Pilbaria cf. **perplexa** Walter 1972

(Fig. 8)

Remarks

Branching-columnar stromatolites that consist of large columns with niches. Columns are erect with irregular margins. Branching into two columns is infrequent. Laminae are gently to steeply convex, with numerous micro-cross laminations. Details of microstructure and fabric cannot be determined because of poor preservation.

These stromatolites are larger than *Pilbaria perplexa* and have less frequent branching and more irregular laminations with numerous micro-crosslaminations. The poor preservation precludes assignment to *P. perplexa*, but the presence of niches indicates that the stromatolites belong to *Pilbaria*.

Distribution and age

Intertidal facies, Duck Creek Dolomite, Wyloo Group, Western Australia, age approximately 2.0 Ga.

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