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BIOSTRATIGRAPHY AND PALEONTOLOGY OF SOME CONCHOSTRACAN-BEARING BEDS IN SOUTHERN AFRICA

by

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CONTENTS

INTRODUCTION

The present field and laboratory study was undertaken in conjunction with a monograph being prepared on Gondwana estheriids. Detailed biostratigraphic reports are lacking on the southern African conchostracan-bearing beds. The available paleontological treatment ranges from mere mentions of certain fossils being present to spare systematics.

During the summer of 1979 a limited exploration program was undertaken at localities in the Clarens Formation (Cave Sandstone) outcrop belt where conchostracans had been reported (Stockley 1947, Haughton 1924, and especially Ellenberger *et al.* 1964). In particular, sites at Siberia and Barkly Pass (both in the Republic of South Africa) and at Thabaneng and Mofoka's Store (both in Lesotho) were found to yield excellent new biostratigraphic and paleontological data.

The exploration covered some 1500 square miles (2400km^2 of the Clarens Formation (Cave Sandstone) outcrop belt (Text fig. 1). Conchostracan-bearing Cave Sandstone sites noted by Paul Ellenberger (1970) at Leloaleng, Masitisi, Mohaleshoek, Brakfontein and elsewhere were systematically explored. Because of the lack of precise locality data enabling one to pinpoint the fossiliferous bed(s) even an intensive search did not uncover the reported fossiliferous beds. Exploration of one of Ellenberger's localities at Wonderkop (RSA) was abandoned after a preliminary search due to time limitations. This site may yet prove productive.

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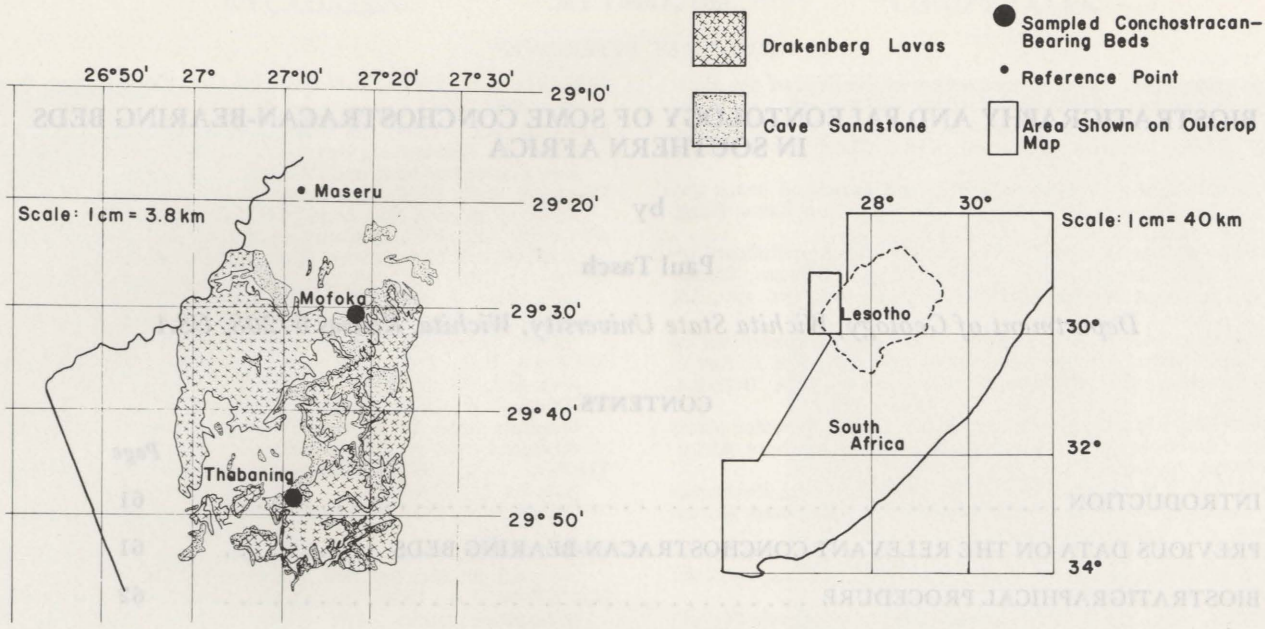
PREVIOUS DATA ON THE RELEVANT CONCHOSTRACAN-BEARING BEDS

The only conchostracan mentioned by Stockley (1947 : 39–49) in his discussion of the Clarens Formation is the occurrence of the branchipod crustacean *Cyzicus (Euestheria) draperi* (Jones and Woodward). This is mentioned as occurring at three localities : near the village of Makolaone (p. 41); Mofoka's Store (p. 42); and in the Setleketseng Valley, close to Lithathone's village (p. 45). Stockley identified the conchostracan species at Mofoka's Store as a "gypsiferous ostracod" (an identification cited also in Haughton 1924). The cyzicid species at Mofoka's Store differs from *Cyzicus (Eu.) draperi* in numerous parameters.

Stockley's field work was essentially reconnaissance in nature.

In a pioneering study of the fauna and stratigraphy of the Stormberg Series, Haughton (1924) discussed a conchostracan species (not figured) as being the same species noted above. It came from "a shale band in the Cave Sandstone, Harrismith, O.F.S.". In his discussion, he also noted a number of specimens from "the shale band at Siberia, Wodehouse, C.P. in the Cave Sandstone" that belonged to this species. Another species, *Cyzicus* sp., was referred to one undetermined by Leriche (1920) from the Lubilash beds. Belgian Congo. For the latter species no southern African locality was given.

Based on explorations that covered decades Ellenberger *et al.* (1964) and Ellenberger (1970) recorded extensive occurrences of vertebrate and



Text Figure 1 Portion of Cave Sandstone outcrop belt in Lesotho.

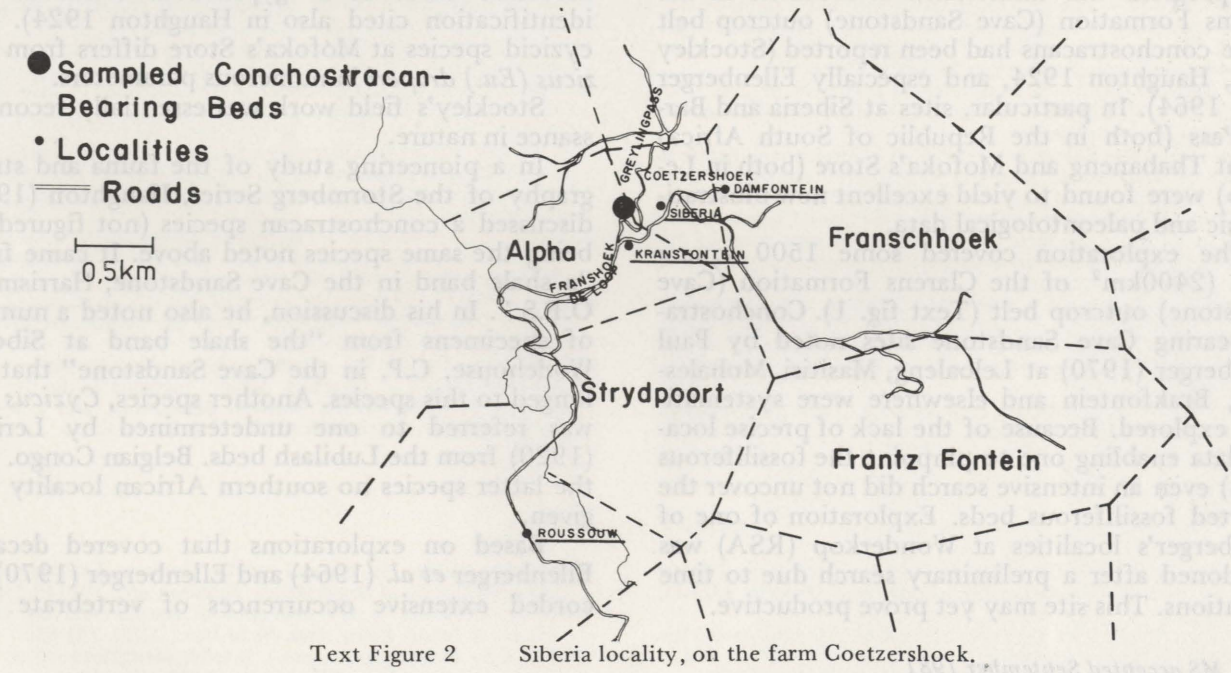
some invertebrate fossils in the southern African Karoo sequence. For ready reference a summary of the conchostracan species reported is given, with the general area and the zone where they were collected (see Appendix 1). Ellenberger noted that his estheriid species from the Cave Sandstone were described by Loup, A., (1963, cit Ellenberger 1940, p. 356), but I have been unable to locate a copy despite extensive enquiries. *E. draperi* (= *Cyzicus (Eustheria) draperi*) was reported to occur at several localities, and *E. stowiana* (= *Cyzicus*) at one of the same localities as "*E. draperi*" species. These two species and another mentioned by Ellenberger, *Cyzicus (Eu.) mangliensis,* are known from the literature (Jones and Woodward 1894; Jones 1862).

BIOSTRATIGRAPHICAL PROCEDURE

Sections were measured by metric rod, Locke level and tape. Fossiliferous beds were sampled in centimeter units for greater precision and to note any vertical changes in the nonmarine biota. The object was to detect seasonal biotic and/or sedimentary events to correlate with the fossil conchostracan and associated biota, if any.

Siberia locality.

This locality, originally explored and described in Haughton's (1924) study of the Stormberg Series, is located on the farm Coetzerhoek (for locality data, see measured section data below). Because erosion, slumping and vegetation obscures much of



Text Figure 2 Siberia locality, on the farm Coetzershoek.

the exposure locally, it was necessary to establish four near-stations and one additional station found to be fossiliferous, in order to obtain a continuous section. All were located over ± 42 m at one exposure along Greyling's Pass (Text fig. 2,3).

The actual measured section, exclusive of the uppermost of three Clarens Formation units was 12,85 meters, while the fossiliferous portion was 7,49 meters.

Siberia (Stations 1A–E). Farm Coetzershoek. Outcropping along Greyling's Pass due west of Siberia. 31°07.5S; 27°17.9E. Outcrop on side of road along contour 5350' (South Africa 1 : 50 000 Sheet, 3127 AB Rossouw, 1st edition, 1968). Distance to station 1A (Text fig. 2) from the bridge on the farm Alpha across the Franshoek se Loop River, 0,9 km. Distance to Station 1A from turn-off to Dordrecht going north, 36,8 km. More than usual details of the precise fossiliferous locality is needed since the literature is devoid of such data.

SIBERIA LOCALITY

Station 1A

Bed No.		Stratigraphy	Thickness (meters)
—	—	Covered; rubble, silty red mudstone	... —
14	—	Black, silty shale. *Cyzicus* sp.	... 0,12
13	—	Same as bed 10; *Cyzicus* sp.	... 0,28
12	—	Same as bed 10; *Cyzicus* sp.	... 0,23
11	—	Same as bed 10; *Cyzicus* sp., *Lepidurus stormbergensis* Haughton, 1924 Ephemeridae (nymph)	... 0,19
10	—	Black waxy and platy to blockly shale. Coleoptera (elytra)	... 0,29
9	—	Black Shale; *Cyzicus* sp.	... 0,88
8	—	Black platy to blocky shale	... 0,16
7	—	Silty black shale with some iron oxide blobs	... 0,14
6	—	Green to black platy shale. Gryllidae (wing); *Cyzicus* sp., *Paleolimnadia* sp.	... 0,18
5	—	Blue black, platy to blocky shale. *Cyzicus* sp., *Paleolimnadia* sp.	... 0,15
4	—	Same lithology and fauna as bed 5 plus *Lepidurus stormbergensis* Haughton, Blattoidea (wing).	... 0,26–0,39
3	—	Hard, thin, laminated green siltstone; mostly covered upwards; (levelled to bed 4). *Lepidurus stormbergensis* Haughton, 1924.	... 0,81
2	—	Covered offset.	... 1,00
1	—	Lower Clarens Formation (levelled to base of bed 3).	... 3,27
			t= 7,94–8,07 meters

Station 1B (offset)

Bed No.		Stratigraphy	Thickness (meters)
1	—	Levelled from top of bed 14 (Station 1A) to base of highest Clarens Formation unit at this site.	... 3,82

Station 1C (21,6 meters N. of Station 1A).

Bed No.		Stratigraphy	Thickness (meters)
2	—	Red siltstone down to rubble	... 0,200
1	—	Blue massive mudstone (=bed 14 Station 1A); fossil plant fragment. 16,5 cm below bed 2	... 0,642
			t= 0,842

Station 1D (31,6+ meters N. of Station 1A)

Bed No.		Stratigraphy	Thickness (meters)
18	—	Upper Clarens Formation, massive red, fining up to red mudstone and siltstone of undetermined thickness.	... 1,09
17	—	Red siltstone interbedded with red mudstone	... 0,60
16	—	Red mudstone	... 0,37
15	—	Blue, black and grey mudstone	... 0,38*
14b	—	Red mudstone grading upward to siltstone	... 0,20*
14a	—	Red siltstone (underlain by red mudstone of undetermined thickness due to scree cover)	... 0,23
			t= 2,87

(* Inadvertently omitted from Fig. 3 by draftsman)

Station 1E (42,0 meters N. of Station 1A, at road level.

Bed No.		Stratigraphy	Thickness (meters)
1	—	Blue gray, waxy blocky shale with crustaceans including conchostracan valves (equivalent to Station 1A, bed 4) contains: *Lepidurus stormbergensis* Haughton, 1924, *Cyzicus* sp., and undetermined insect.	... 0,33

FAUNA

The beds within the lower 7,0+ meters contain the bulk of the fauna, which consists of conchostracans, notostracans and insects (mayflies cockroaches, beetles and others); many of the components were described by Haughton (1924). A rare example of preserved plant material occurs in the lower bed of Station 1C.

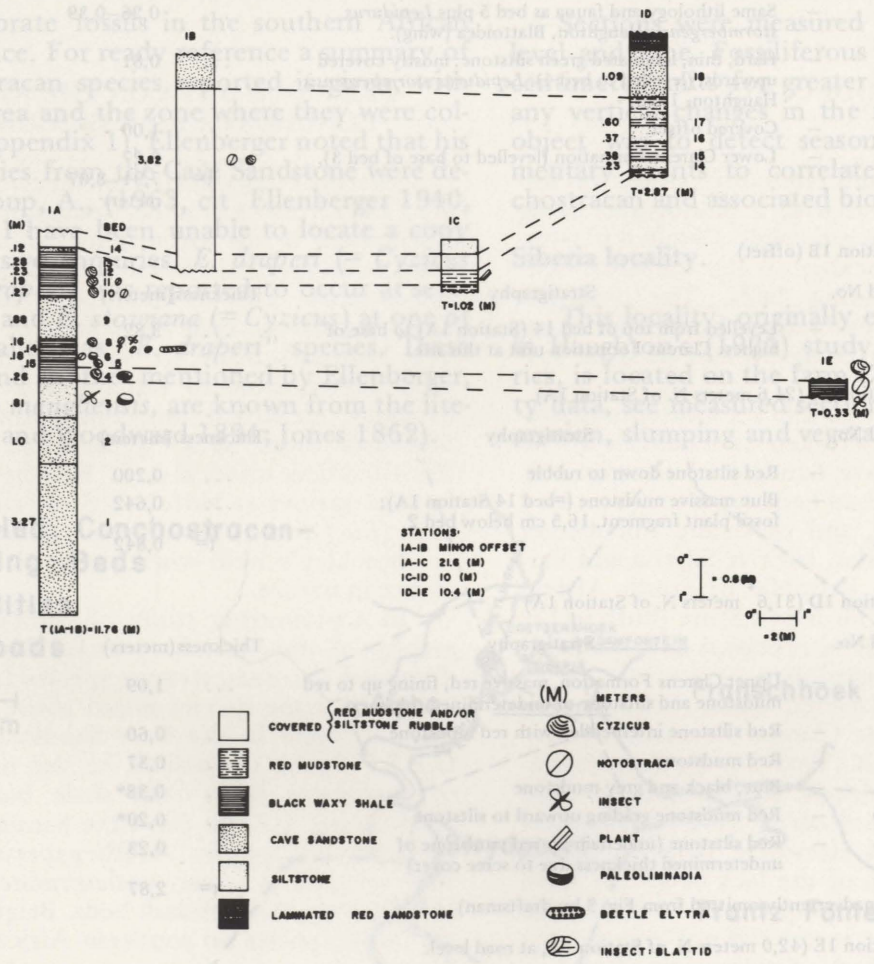
The fossils are generally poorly preserved. Due to fragility, the hard brittle mudstones tend to crumble when touched or excavated.

At Station 1A, the most complete measurable sequence of successive beds (4–6) has a distinctive faunal assemblage that seems to be an acceptable zone in the sequence. These beds contain a large conchostracan valve (? *Paleolimnadia*), the notostracan *Lepidurus stormbergensis,* a fossil roach, and *Cyzicus* sp. The same notostracan occurs in bed 3 with no other faunal elements, and recurs in bed 11, with insects. The distinctive insects in beds 4, 10, and 11 are of interest in that they do not recur in any other beds of the section. Several cyzicid species (genus *Cyzicus*) are present but they cannot help in zonation until identified at the species level, a process currently underway.

The present study precisely locates the faunal components in the composite section relative to the Clarens Formation (Cave Sandstone) units. Furthermore, a few species of *Cyzicus* and a probable paleolimnadiid not previously reported at this or any other southern African sites, were uncovered. The lower 5,08 meters (sandstone and siltstone) have yielded no fossils. The fossils were recovered mainly from beds 4 and 13, with sporadic other occurrences. The upper 2,87 meters were also barren. It is thus clear that conditions before and after bed 3 through bed 14 did not support the aquatic life common to small pond/lake situations.

LITHOLOGY

A repetitive thin sequence (1,78 meters) of siltstone fining up to red mudstone occurs at Station 1D (beds 14 through 17). Three such fluvial cycles were recorded (Text fig. 3, Station 1D). These



Text Figure 3 Siberia Locality:

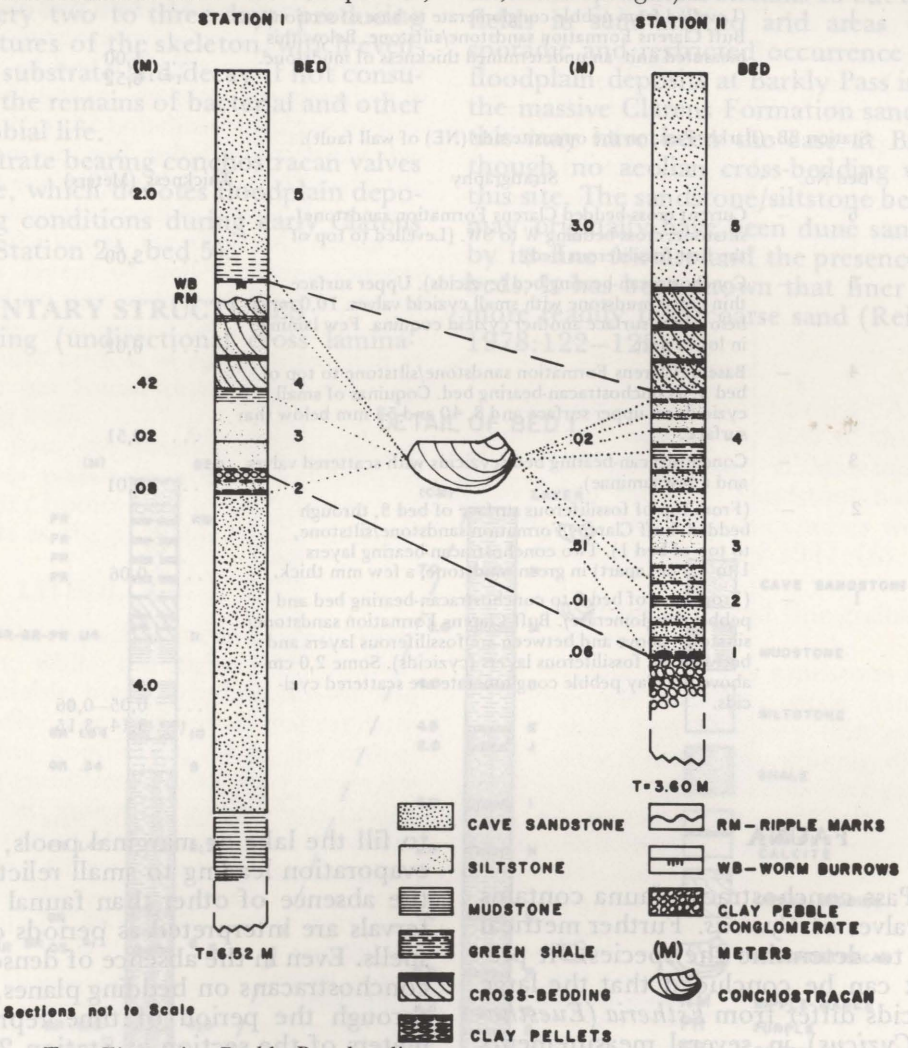
Conchostracan-bearing beds in the Clarens Formation (Cave Sandstone).

cycles preceded deposition of the overlying red Clarens Formation (the uppermost unit in the Siberia section). The new data expand an observation by Haughton (1924: 478) that the base of the Clarens Formation (Cave Sandstone) is generally red and often bedded, and that this indicates a continuance of the floodplain deposit of the semi-arid Red Beds time. Beukes (1970) found the same to hold in his study of the stages of the Clarens Formation (cf. Collinson 1978). The Siberia outcrop would be in Beukes' stratigraphic zone 1, and deposited under semi-arid conditions (Beukes 1970: 327, zone 1).

Living conchostracan/notostracan faunas generally favour ephemeral water bodies of limited extent and of seasonal duration. With rare exceptions, fossil evidence throughout this section of the rock column on all continents indicates seasonal drying conditions affecting restricted water bodies such as small lakes. During evaporation relict ponds, pools or puddles become habitats for varied branchiopod crustaceans when wind dispersal of dried muds transports crustacean eggs.

Barkly Pass Locality

Map sheet 3127 BB, Barkly Pass, Republic of South Africa, 1:50 000, 1st ed. 1968. Measured sections: Farm 1937. Station 2 is 400 meters from the 48 km marker on Barkly Pass, on a low step-up platform bordering a sandstone wall (See Text fig. 4; Plate 1 Fig 1).



Text Figure 4 Barkly Pass locality: Conchostracan-bearing beds in the Clarens Formation (Cave Sandstone).

BARKLY PASS LOCALITY

Station 2A

Bed No.	Stratigraphy	Thickness (Meters)
5	— Massive, cross-bedded Clarens Formation sandstone/siltstone; red on fossiliferous upper surface, to green and buff below. Layered with numerous coconut-calcite partings. Large cyzicids occur on three surfaces: upper, 5 and 4 mm below upper. Local fault on sandstone wall margining platform. Section NE of fault.	... 2,00

Bed No.		Stratigraphy	Thickness (Meters)
4	–	Buff, cross-bedded Clarens Formation sandstone/siltstone; upper portion with 10,0 mm band of wavy laminae; topped by a thin layer of green mudstone with numerous small cyzicid valves. The upper laminated 5,0 mm has conchostracan fossils (cyzicids), with at least two other laminae below, the top also containing cyzicids. Lower 8,0 cm well bedded but some rolled beds. In between cross-bedding are wavy, argillaceous laminae, overlain by horizontal beds, and include a small amplitude ripple mark. Top of bed (in side view) records bioturbation (burrows).	... 0,42
3	–	Buff Clarens Formation sandstone/siltstone with wavy laminae in upper 30,0 mm, topped by a green mudstone layer bearing small cyzicid fossils, mostly fragmentary. Laminae vertically displaced and disturbed by a mini-fault.	... 0,20
2	–	Buff Clarens Formation sandstone/siltstone, topped by green mudstone with a few small cyzicids. Upper 6,0 mm with wavy bedding. Lowermost portion a clay pebble conglomerate layer with scattered cyzicids and clay pellets (conchostracans in pellets). Another discontinuous conchostracan-bearing layer at base of pebble conglomerate.	... 0,80
1	–	(Levelled from pebble conglomerate to base of section). Buff Clarens Formation sandstone/siltstone. Below this measured unit an undetermined thickness of mudstone.	... 4,00 t= 6,52

Station 2B. (Barkly Pass, on the opposite side (NE) of wall fault).

Bed No.		Stratigraphy	Thickness (Meters)
6	–	Current cross-bedded Clarens Formation sandstone/siltstone; cross-bedding W to SW. (Levelled to top of the first fossiliferous bed).	... 3,00
5	–	Conchostracan-bearing bed (cyzicids). Upper surface thin green mudstone with small cyzicid valves. 10,0 mm below that surface another cyzicid coquina. Few laminae in lower part	... 0,02
4	–	Base of Clarens Formation sandstone/siltstone to top of bed 3, a conchostracan-bearing bed. Coquinas of small cyzicids on upper surface and 8, 40 and 53 mm below that surface.	... 0,51
3	–	Conchostracan-bearing bed (cyzicids with scattered valves and a few laminae).	... 0,01
2	–	(From top of fossiliferous surface of bed 3, through bedded, buff Clarens Formation sandstone/siltstone, to top of bed 1). Two conchostracan-bearing layers 1 to 1,5 cm apart) in green mudstone, a few mm thick.	... 0,06
1	–	(From base of bed 2 to conchostracan-bearing bed and pebble conglomerate). Buff Clarens Formation sandstone/siltstone; above and between are fossiliferous layers and between are fossiliferous layers (cyzicids). Some 2,0 cm above the clay pebble conglomerate are scattered cyzicids.	... 0,05–0,06 t= 3,14–3,15

FAUNA

The Barkly Pass conchostracan fauna contains small and large valves of *Cyzicus*. Further metrical study is needed to determine the species. At present, however, it can be concluded that the large Barkly Pass cyzicids differ from *Estheria (Euestheria) draperi* (= *Cyzicus*) in several measurements and valve characteristics and cannot be assigned to that species (for further discussion and data, see under "Systematic Descriptions").

At Station 2B, small cyzicid fossils occur in coquinas suggesting sudden evaporation of the shallow water cover leading to mass demise of the microfauna. At times such events recurred, as indicated by data from Station 2B, bed 4, where four distinct layers have coquinas. This has climatological implications; not only was there sporadic rain to fill the lake or marginal pools, but also periodic evaporation leading to small relict water bodies. In the absence of other than faunal evidence, the intervals are interpreted as periods of prolonged dry spells. Even in the absence of denser populations of conchostracans on bedding planes, their recurrence through the period of time represented by 1,42 meters of the section at Station 2A testifies to repetitive but irregular in-fill of depressions in the sandy substrate. This recurrence spanned relatively short time periods (several seasons) separated by beds representing times of dry conditions Valves are generally flattened against the bedding plane, and there is no evidence of any associated fauna except one instance of burrows. Such observations point to an ephemeral situation, where fortuitous formation of a restricted waterbody and subsequent transport of crustacean eggs by wind allowed

one or several seasons of conchostracans to thrive. Coquinas may also represent greatly increased populations leading to exhaustion of the limited food supply.

LITHOLOGY

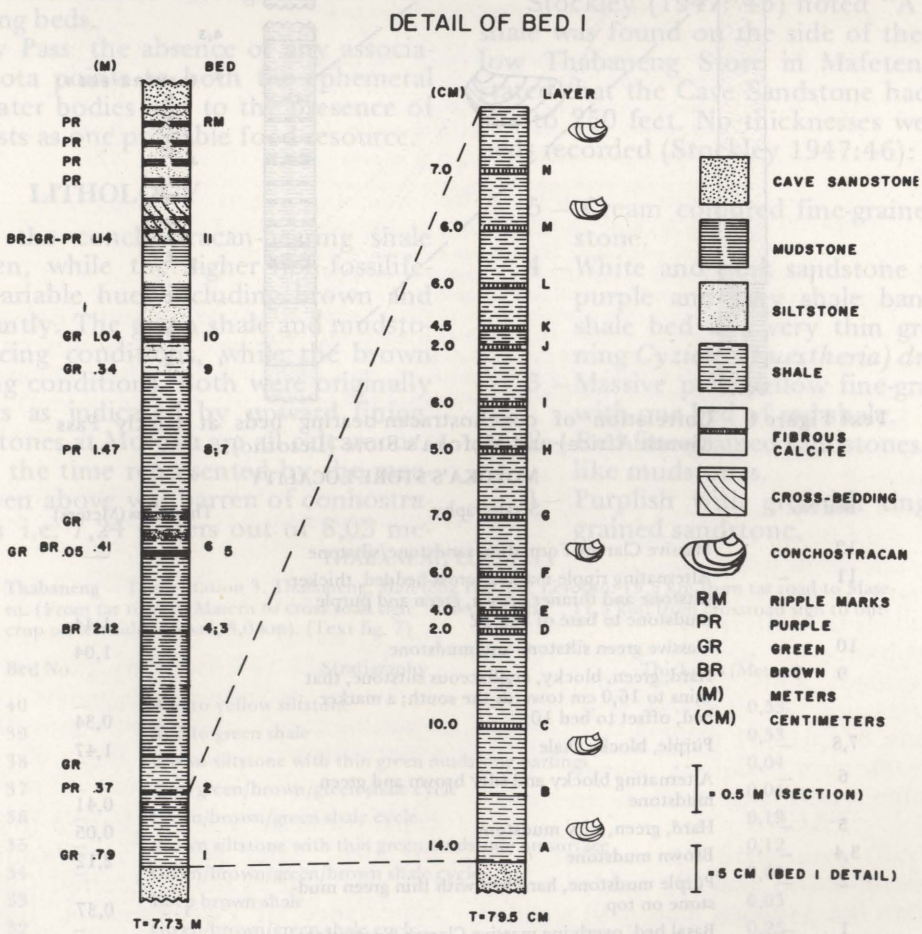
The substrates in which the conchostracan valves were preserved were originally green mud, generally indicative of reducing conditions Although no other organic remains have been preserved, there are three sources of organic matter that could induce such reduction through their decay: shed unhatched conchostracan eggs which, in the absence of predation, would have been buried by new sediment influx; molting, which occurs in conchostracans about every two to three days producing chitinous duplicatures of the skeleton, which eventually fall to the substrate and decay if not consumed; and finally the remains of bacterial and other soft-bodied microbial life.

Another substrate bearing conchostracan valves is a red mudstone, which denotes floodplain deposits and oxidizing conditions during early Clarens Formation time (Station 2A, bed 5).

SEDIMENTARY STRUCTURES

Current bedding (undirectional cross lamination) (cf. van Dijk *et al* 1978) recorded at Station 2B, bed 6, is a further indication of a fluvatile-floodplain setting. The conchostracan fossils denote shallow water bodies on the floodplain that underwent evaporation. Other sedimentary structures include: wavy, argillaceous laminae, small amplitude ripple marks, and burrows (all in bed 4, Station 2A): mini faults involving several thin sedimentary layers or a larger wall fault in the Clarens Formation sandstone/siltstone; and rolled beds.

Of interest is the absence of any fossil plant fragments, and salt during times of evaporation. In the Barkly Pass area the landscape was apparently barren of vegetation, and rainwater or overflow of an ephemeral fluve was salt free. It is not uncommon for ephemeral streams to cut across sand dune fields in semi-arid to arid areas Considering the sporadic and restricted occurrence of fluvatile and floodplain deposits at Barkly Pass in the context of the massive Clarens Formation sandstone/siltstone, this may have been the case at Barkly Pass, even though no aeolian cross-bedding was observed at this site. The sandstone/siltstone bed at Barkly Pass may originally have been dune sands as suggested by its fine texture and the presence of some rolled beds. It has been shown that finer dune sand rolls more readily than coarse sand (Reineck and Singh 1978:122–123).



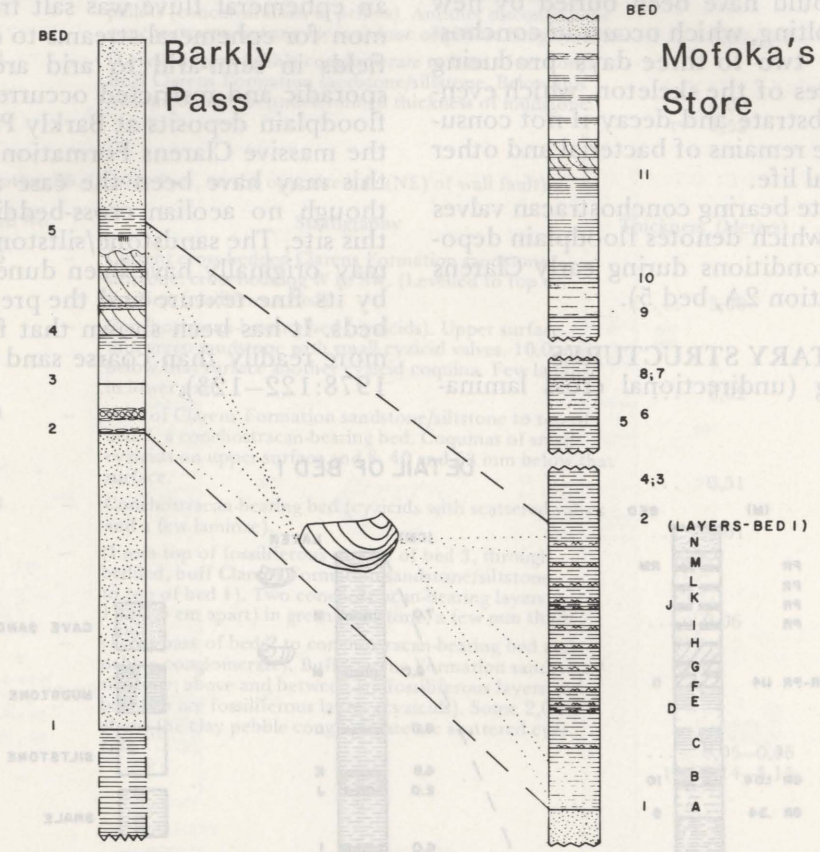
Text Figure 5 Mafoka's Store locality, Maseru District, Lesotho: Conchostracan-bearing beds in the Cave Sandstone.

Mofoka's Store Locality

Stockley (1947: 64–65 measured 500 feet of the Clarens Formation at this site, but thicknesses were not given for his beds 7 and 8. His beds 6 through 8, and particularly bed 7, cover the relevant units. As noted earlier, *Cyzicus (Eu.) draperi* is not an ostracod and is not gypsiferous. The fossil conchostracans at this locality (Tasch bed 1 ≡ Stockley bed 7) were found between successive calcite layers (see Text fig. 5,6 for details). (Tested with Alizarin red stain, the powdered fibrous calcite layers and the white bands of the valve turned red, as expected for calcite.)

The species at this site is identical with that at Barkly Pass, not merely in configuration and parameters, but also in having precisely the same mode of preservation : white tracings of the valve and some of its growth bands, flattened on the bedding plane. At neither of these two localities is the species collected assignable to *Cyzicus (Eu.) draperi* (see Systematic Descriptions).

Mofoka's Store – Tasch Station 4, Maseru District, Lesotho. SW spur of hill seen from Frazer's Store; right side of ridge, along lower portion of slope bordering highest horizontal footpath (Text fig. 6 and Plate 2 Figs. 1–3).



Text Figure 6 Correlation of conchostracan-bearing beds at Barkly Pass (South Africa) and Mofoka's Store (Lesotho).

MOFOKA'S STORE LOCALITY

Bed No.		Stratigraphy		Thickness (Meters)
12	–	Massive Clarens Formation sandstone/siltstone	...	—
11	–	Alternating ripple-marked, cross-bedded, thicker siltstone and thinner brown, green and purple mudstone to base of bed 12	...	1,44
10	–	Massive green siltstone and mudstone	...	1,04
9	–	Hard, green, blocky, argillaceous siltstone, that thins to 16,0 cm towards the south; a marker bed, offset to bed 10.	...	0,34
7,8	–	Purple, blocky shale	...	1,47
6	–	Alternating blocky and silty brown and green mudstone	...	0,41
5	–	Hard, green, silty mudstone	...	0,05
3,4	–	Brown mudstone	...	2,12
2	–	Purple mudstone, hard bed with thin green mudstone on top	...	0,37
1	–	Basal bed, overlying massive Clarens Formation sandstone/siltstone (= Stockley's bed 6). Green blocky shale; massive to layered towards top of bed; green shale overlain by alternating green shale and fibrous calcite layers. Fossil conchostracans (*Cysicus* sp. see systematic description) between repetitive fibrous calcite layers	...	0,79
			t=	8,03

FAUNA AND SUBSTRATE

The conchostracan species at this site recurred between calcite intervals (fibrous calcite layer followed by fossiliferous green shale followed by another fibrous calcite layer). In a thickness of 79 cm (bed 1) some 13 successive layers of a cyzicid species are represented, denoting that they repeatedly inhabited the same restricted water body at this site.

There were, in addition, other fossil occurrences not between fibrous layers: Bed 1, Unit A in a light green mudstone directly in contact with the basal massive Clarens sandstone/siltstone, and also above the highest fibrous layer (N). (Text fig. 5).

The large fossils (*Cyzicus* sp.) recur on successive bedding planes and also as coquinas, the latter denoting possible evaporative events. In the lowermost green shale of bed 1 fossils were sparse, but subsequently population density increased. On three different layers the conchostracan valves showed marginal damage and subsequent repair between fibrous layers 4,5, and 6, 7 and above the fibrous 12. This suggests possible cannibalism since no predator remains occur anywhere in the successive fossiliferous layers of bed 1. The recurrent cannibalism could be due to loss of food resources as the water body evaporated – a situation that may have been more critical at some times than at others and hence not found throughout the conchostracan-bearing beds.

As at Barkly Pass the absence of any associated fossilized biota points to both the ephemeral nature of the water bodies and to the presence of softbodied protists as one probable food resource.

LITHOLOGY

At Mofoka, the conchostracan-bearing shale was chiefly green, while the higher non-fossiliferous beds had variable hues including brown and green predominantly. The green shale and mudstone implies reducing conditions, while the brown suggests oxidizing conditions. Both were originally fluvatile deposits as indicated by upward fining. Shales and mudstones at Mofoka are all calcareous.

The bulk of the time represented by the measured section given above was barren of conhostracan-bearing beds i.e. 7,24 meters out of 8,03 meters. Higher in the section, the alternating siltstones and mudstones (not necessarily in a consistent alternating pattern) appears to represent a more erratic variant of the fluvial cycles observed at the Siberia locality.

Sedimentary structures. Alternating ripple marks and cross bedding were recorded in bed 11. Since the lower portions of this section were all structureless, an important change is signified by the occurrence of these structures in the uppermost bed below the massive Clarens Formation sandstone/siltstone. The change appears to have been from fluvatile deposition to aeolian (cf. Beukes 1970, Zone 1).

The recurrent fibrous calcite layers indicate a small basin on a floodplain that evaporated repeatedly; it then refilled with water turbid with suspended clay or mud. This indicates repeated overflow of the shallow stream bank. Successive influxes of conchostracan eggs from elsewhere on the floodplain are also suggested. Transport of such eggs would be by wind from dried sediment of former temporary pools or ponds. From the oldest to the youngest fibrous calcite layers the sediment interval was as follows (in cm): 10, 2, 4, 6, 7, 5, 6, 2, 4, 5, 6, 6, 7.

Thabaneng Locality.

Stockley (1947: 45) noted "A fourth ostracod shale was found on the side of the motor road below Thabaneng Store in Mafeteng District". He stated that the Cave Sandstone had thinned at this site to 250 feet. No thicknesses were given for the beds recorded (Stockley 1947:46):

5 – Cream coloured fine-grained bedded sandstone.
4 – White and pink sandstone with green, red, purple and grey shale bands The lowest shale bed is a very thin grey shale containing *Cyzicus (Euestheria) draperi.*
3 – Massive pale yellow fine-grained sandstone with one bed of red shale.
2 – Red fine-grained sandstones, which weather like mudstones.
1 – Purplish with greenish tinge bedded fine-grained sandstone.

THABANENG LOCALITY

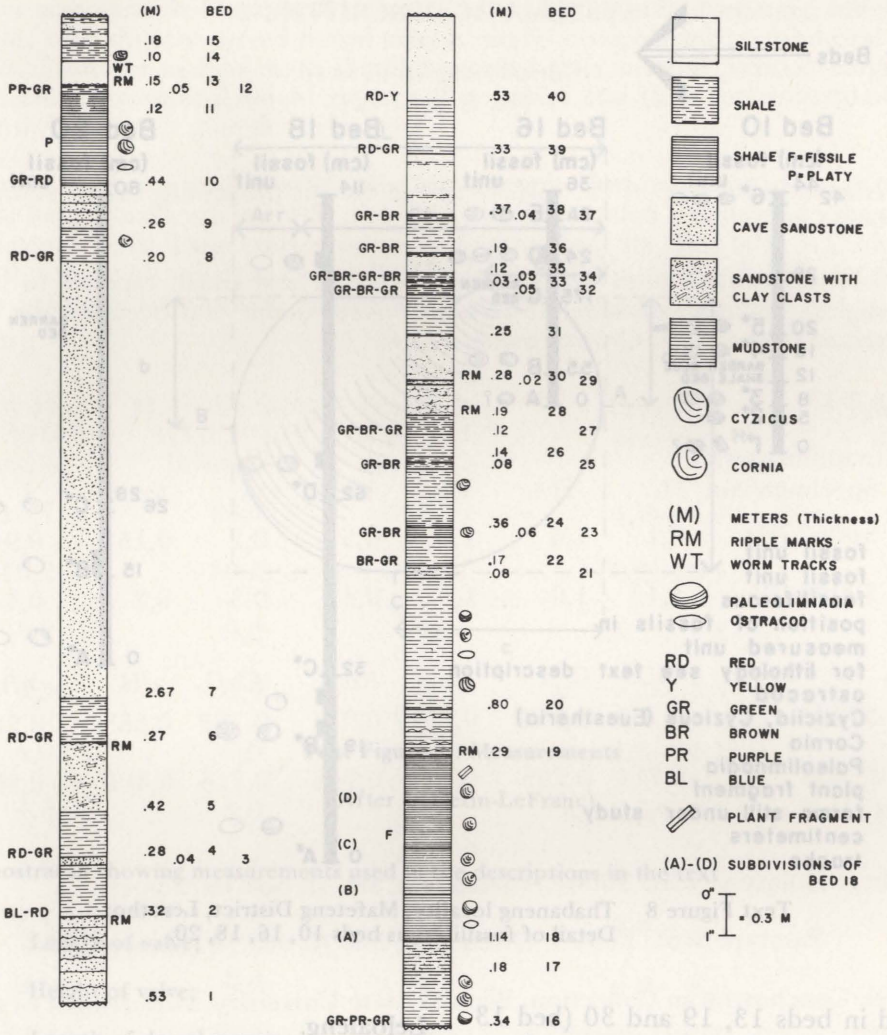
Thabaneng – Tasch Station 3. Thabaneng, Mafeteng District, Lesotho. 19,5 km from tar road to Maseru. (From tar road to Maseru to cross road sign "Frazer's Qabo", 11,5 km; from crossroad sign to outcrop on left side of road, 8,0 km). (Text fig. 7).

Bed No.	Stratigraphy	Thickness (Meters)
40 –	Red to yellow siltstone ...	0,53
39 –	Red to green shale ...	0,33
38 –	Brown siltstone with thin green mudstone partings ...	0,04
37 –	Thin green/brown/green shale cycle ...	0,04
36 –	Green/brown/green shale cycle ...	0,19
35 –	Brown siltstone with thin green mudstone on surface ...	0,12
34 –	Green/brown/green/brown shale cycle ...	0,05
33 –	Deep brown shale ...	0,03
32 –	Green/brown/green shale cycle ...	0,25
31 –	Brown mudstone ...	0,25
30 –	Siltstone with ripple marks and minute concrections (white to brown stained calcite); pock marked where concretions have weathered out of rock ...	0,28

29	–	Green mudstone	...	0,02
28	–	Brown siltstone with clasts; small amplitude ripple marks throughout	...	0,19
27	–	Green/brown/green shale cycle	...	0,12
26	–	Dull brown, blocky shale; green at base with three thin mudstone partings	...	0,14
25	–	Blocky, light brown shale with green mudstone partings	...	0,08
24	–	Brown blocky shale with green shale at base. *Cyzicus* sp. 10,0 cm below top of bed in a layer of red argillaceous siltstone	...	0,36
23	–	Green to brown shale with poorly preserved conchostracan	...	0,06
22	–	Brown to green shale	...	0,17
21	–	Grey argillaceous siltstone	...	0,08
20	–	Dull, blocky red shale; lower 15 cm and 26–28 fossiliferous. Divided into three units: A-basal unit; B-middle unit; and C-upper unit. A-*Cyzicus (Eu.)*, ostracods; B-*Cyzicus* sp.; C-*Cyzicus (Eu.); Cornia, Paleolimnadia (Grandilimnadia)* sp. (See detail bed 20, Text fig. 8.) From 28–80 cm above base of bed, dull red weathering, a barren bed	...	0,80
19	–	Green silty mudstone; 17 cm to the west facies changes to sandstone. Ripple marked, drift direction 41° NE (measured by J.C. Loock)	...	0,29
18	–	Black fissile fossiliferous shale. Divided into four units, A-basal, D-uppermost. A-cyzicid, ostracods B-*Cyzicus, Cyzicus;* C-*Cyzicus,* numerous ostracods; D-(Lower cyzicids, few ostracods D-upper cyzicids, ostracods, a single fossil plant fragment. (see detail, bed 18, Text fig. 8).	...	1,14
17	–	Thin bedded argillaceous siltstone	...	0,18
16	–	Alternating green/purple/green fossiliferous mudstone. Divided into five units: A-basal unit, cyzicid; B-(5,5–17,5 cm) *Cornia, Cyzicus;* C-(17,5–24,0 cm) barren bed; D-(24,0-31,0 cm) *Cornia, Paleolimnadia, Cyzicus;* E-(31,0–36,0 cm) *Cornia, Cyzicus.* (see detail, Text fig. 8).	...	0,36
15	–	Very thin siltstone alternating with thin green mudstones	...	0,18
14	–	Green shale with conchostracans at base (poor reservation).	...	0,10
13	–	Hard green siltstone, medium bedded; worm tails on surface; ripple marks directly below bed 13.	...	0,15
12	–	Purple to green shale	...	0,05
11	–	Green silty mudstone passing into sandstone to the west	...	0,12
10	–	Thin bedded, platy fossiliferous red shale; at base some green shale. Divided into six units :1 (basal unit) (0,0–5,0 cm) many fragmentary conchostracans and few fossil plant fragments; 2 (5,0–8,0 cm) *Cyzicus (Euestheria);* 3 (8,0–12,0 cm) *Cornia, Cyzicus;* 4 (12,0–16,0 cm) barren blue shale; 5 (16,0–20,0 cm) *Cornia, Cyzicus;* (20,0–29,0 cm) *Cornia, Cyzicus,* ostracods, tracks (?); (29,0–42,0 cm) barren; 6 (42,0–44,0 cm) (top of bed) *Cornia, Cyzicus* ostracods	...	0,44
9	–	Thin bedded sandstone	...	0,26
8	–	Red passing into green shale. Between 5,0 and 8,0 cm above base, *Cornia*	...	0,20
7	–	Massive, bedded Clarens sandstone; strike of current direction 45°, 51°, 47° NE (measured by J.C. Loock).	...	2,67
6	–	Red to green shale	...	0,27
5	–	Sandstone with clay casts; very closely spaced ripple marks on top of bed	...	0,42
4	–	Red to green shale passing up to gray clay	...	0,28
3	–	Thin sandstone layer	...	0,04
2	–	Blue grading up to red shale	...	0,32
1	–	Basal bed, Clarens sandstone; fine grained; wavy to parallel bedding, ripple marks on upper surface).	...	1,53
			t=	13,29

FAUNA

The oldest fossiliferous bed (8) yielded a new species of *Cornia;* the younger bed (10) yielded *Cyzicus (Euestheria)* sp., followed by the same species plus *Cornia* sp. Tracks, ostracods and the two conchostracan genera occurred towards the top of the bed. After several nonfossiliferous intervals, corniids and cyzicids recurred (bed 16); the first appearance of *Paleolimnadia,* together with the abovementioned conchostracan genera, occurred slightly over 24 cm above the base. Thereafter cy-



Text Figure 7 Thabaneng locality, Mafeteng District, Lesotho: Continuous section, conchostracan-bearing beds in the Cave Sandstone.

zicids and ostracods predominated (beds 18 and 20) with the single recurrence of *Cornia* sp. in each of these beds. Cyzicids and *Paleolimnadia* are also associated with *Cornia* in bed 20. The youngest conchostracan fossil in the section was a cyzicid from bed 24.

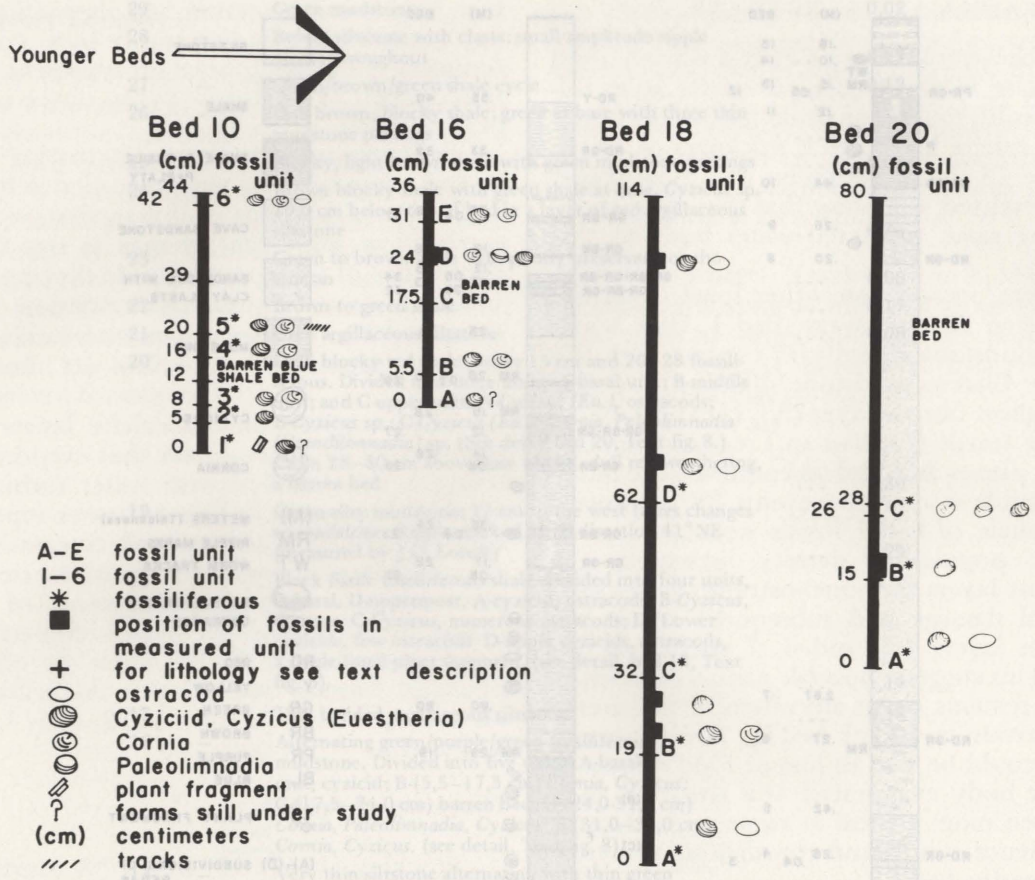
As will be obvious from the above microstratigraphic sequence and section, the precise biotic succession through time can be detected (first appearances, disappearances, and seasonal events) (Text fig. 8). Although *Cyzicus* followed *Cornia* originally, it became dominant (see detail of bed 18 and 20 as compared with bed 24). I have discussed competition among conchostracans elsewhere (Tasch 1979). During a portion of the time represented by bed 20, unit C, three conchostracan genera coexisted in the same water body, but thereafter only *Cyzicus* survived, and then only briefly in bed 24. From bed 25 through 40, (some 2,54 m of the section) no fossils occurred, denoting a dying out of the remaining cyzicid population after bed 24 time, with no recruits from wind-blown eggs of other populations that may have coexisted on the floodplain of the time.

LITHOLOGY

The successive green and red (or brown) siltstone, silty mudstone and shale suggest a fluvatile (floodplain) sequence. Red and green coloration denote oxidizing and reducing conditions respectively. That in turn fits the concept of an evaporating lake or floodplain pond. Decaying remains of the relict microbiota could have led to fouled bottom conditions which disappeared when water refilled the basin seasonally or after a lapse of several seasons, (i.e. by overflow of shallow stream banks).

This inference is supported by the occurrence of a comparatively thick, fossiliferous, black fissile shale. It is probable, but not certain, that the barren units in beds 10, 16, 18 and 20 in particular may denote complete evaporation (drying-up) of the very shallow, temporary water body at Thabaneng.

Sedimentary Structures. Clay casts in siltstone (beds 5 and 28) may be interpreted as broken fragments of a dried mud bottom redistributed close to their source (cf. Blatt et al. 1972:286). Bed 28 had repetitive ripple marks throughout. Ripple marks



Text Figure 8 Thabaneng locality, Mafeteng District, Lesotho: Detail of fossiliferous beds 10, 16, 18, 20.

were also recorded in beds 13, 19 and 30 (bed 13 also having worm trails), and on the upper surfaces of beds 5 and 1. In bed 1 the geologically older wavy bedding may represent still other ripple marks. Such recurrences of preserved current action support the interpretation of very shallow water cover.

White to brown-stained minute calcitic concretions were found in bed 30, which presented a pocked surface of minute holes where concretions had weathered out. These surficial concretions are the end product of evaporation (cf. Reineck and Singh 1975:253). The minifacies change from green silty mudstone to sandstone in a westerly direction (bed 19, cf. bed 11), a transition from fine to coarse sediment, supports the floodplain-deposit explanation referred to above.

FURTHER FIELD RECONNAISSANCE IN LESOTHO

Thabaneng.

Higher upslope along the motor road and considerably above Tasch station 3, the Drakensberg lava was in direct contact with the Clarens Formation. Because of time limitations, no attempt was made to determine the interval between the top of bed 40 (Tasch Station 3) and the base of the Drakensberg lavas.

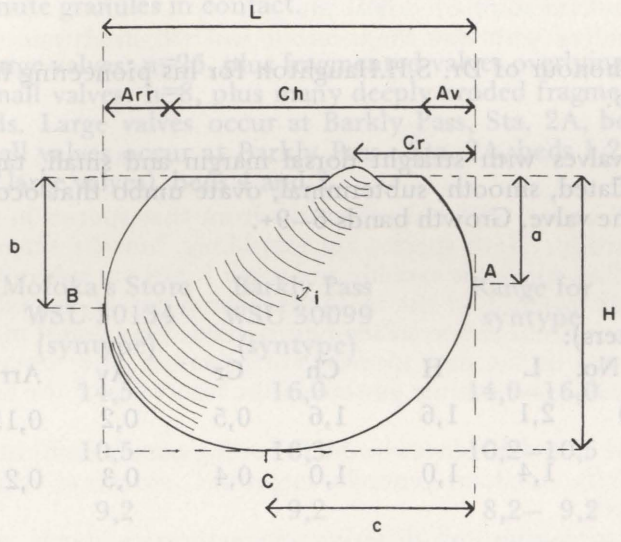
Leloaleng.

(1) East over the hill past Ellenberger's dinosaur footprint reserve, then turn south and ascend to top of another hill and descend a short distance to a small village at the base of the massive Clarens sandstone. Clear current ripples noted in one sandstone layer. At a higher elevation, Drakensberg green and red lava rubble along a slope marked the contact with the Clarens Formation.

(2) A pocket of green to blue shale at the base of the massive Clarens sandstone was found to be unfossiliferous.

Mohaleshoek. (First hill outside Mohaleshoek).

Sharp contact of Drakensberg lavas and upper massive Clarens sandstone. (For other data on the Drakensberg contact see Hall and Borns 1980.) Below the sandstone, the transition bed of mostly green silty mudstones was found to be unfossiliferous. At another sector of the same hill, the uppermost of three Clarens Formation units separated by green silty shale from the next underlying sandstone unit had at its base a pebble conglomerate with bone fragments and green clay and other pebbles. Below the lowermost of the three sandstone units, several pockets of red and green silty shale were found to be unfossiliferous.



Text Figure 9 : Measurements

(After Defretin-LeFranc)

Schematic conchostracan showing measurements used in the descriptions in the text

L	=	Length of valve;
H	=	Height of valve;
Ch	=	Length of dorsal margin;
Cr	=	Distance of umbo to most anterior part of the valve;
Av	=	Distance of the anterior extremity of the dorsal margin to the most anterior part of the valve;
Arr	=	Distance of the posterior extremity of the dorsal margin to the most posterior part of the valve;
A	=	Point of the maximum anterior bulge;
B	=	Point of the maximum posterior bulge;
C	=	Point of the maximum ventral bulge;
a	=	Distance of A to the dorsal margin;
b	=	Distance of B to the dorsal margin;
c	=	Distance of C to the most anterior part of the valve;

RATIOS : H/L; Cr/L; Av/L; Arr/L; Ch/L; a/H; b/H; c/L.

SYSTEMATIC DESCRIPTIONS

Cornia haughtoni n. sp.
(Pl. 3 figs 1–2)

Name: Named in honour of Dr. S.H.Haughton for his pioneering faunal studies of the Stormberg Group.

Description: Subovate valves with straight dorsal margin and small, tapered to blunt node on a slightly inflated, smooth, subterminal, ovate umbo that occupies the antero-subdorsal sector of the valve. Growth bands 6–9+.

Sample size: n = 13.

Measurements (in millimeters):

Specimen No.	L	H	Ch	Cr	Av	Arr	a	b	c
30067 (H)	2,1	1,6	1,6	0,5	0,2	0,15	0,9	0,45	1,2
30068 (P)	1,4	1,0	1,0	0,4	0,3	0,2	0,4	0,45	1,2

	H/L	Cr/L	Av/L	Arr/L	Ch/L	a/H	b/H	c/L
30067	0,762	0,238	0,095?	0,071	0,762	0,563	0,281	0,571
30068	0,714	0,286	0,214	0,143	0,714	0,400	0,300	0,286

H–Holotype, P–Paratype

Types and Locality: Holotype WSU 30067. Thabaneng, Sta. II, bed 16 (Upper).

Paratype WSU 30068. Thabaneng, Sta. II, bed 18 (Lower).

Repository: Tasch Conchostracan Collection, Wichita State University, Department of Geology.

Discussion: The new species is unlike any of the Russian corniids (Triassic) described by Novojilov, Molin, Lutkevich (Novojulov 1970: 135–150) in valve configuration, curvature of the dorsal margin (in some only), size and shape of the umbo, and position of the umbonal node. Zaspelova (1965, pl. 1 VII) has lower Triassic corniid species mostly with a medial umbo; two others have a subterminal node on a smaller umbo.

The above review suggests that the Lesotho species is sufficiently distinct in the critical umbonal characteristics to merit taxonomic recognition.

Cyzicus (Euestheria) stockleyi, n.sp.

(Pl. 3 figs 3–4)

Cyzicus (Eu.) draperi (Jones & Woodward) Haughton

Stockley 1947:44)

Name: Name in honour of G.M. Stockley for his pioneer work in Basutoland (Lesotho).

Description: Valve size variable from small to large (5,0 to 15,0 mm in diameter), suboblong to subovate, with slightly curved dorsal margin; umbo occupies antero-subdorsal sector of the valve. Posterior margin more sharply rounded than anterior; ventral margin gently curved. Dorsal-to-ventral height shorter at posterior end than anterior end of valve. Ornamentation minute granules in contact.

Sample Size and Locality: Large valves: n=25, plus fragmented valves overlying valves in coquina in several beds. Small valves: n=8, plus many deeply eroded fragmented valves in a coquina in several beds. Large valves occur at Barkly Pass, Sta. 2A, beds 1.1, Mofokas Store, basal bed; small valves occur at Barkly Pass., Sta. 2A, beds 1,2, 1,3; and Sta. 2B (together with rare large valves), beds 4 and 2.

Measurements (mm);

	Barkly Pass WSU 30102 (syntype)	Mofoka's Store WSU 30134 (syntype)	Barkly Pass WSU 30099 (syntype)	Range for syntype	*Cyzicus (Eu.) draperi*
L–	15,7	14,5	16,0	14,0–16,0	16,0
H–	10,2	10,5	10,3	10,2–10,5	10,5
Ch–	8,2	9,2	9,2	8,2– 9,2	11.0*
Cr–	5,5	5,0	5,5	5,0– 5,5	6,5
Av–	4,5	4,0	4,7	4,0– 4,7	2,5*
Arr–	4,5	4,0	3,7	3,7– 4,5	3,0
a–	4,0	4,5	4,1	4,0– 4,5	3,5
b–	4,1	5,5	4,0	4,0– 5,5	4,0
c–	8,0	6,0	6,5	6,0– 8,0	9,0*
H/L–	0,650	0,724	0,644	0,644–0,724	0,606
Cr/L–	0,350	0,344	0,344	0,344–0,350	0,393
Av/L–	0,287	0,276	0,294	0,276–0,294	0,151*
Arr/L–	0,287	0,276	0,131	0,231–0,287	0,181*
Ch/L–	0,522	0,634	0,575	0,522–0,634	0,696*
a/H–	0,392	0,429	0,398	0,392–0,429	0,350
b/H–	0,402	0,424	0,388	0,388–0,524	0,400
c/L–	0,510	0,414	0,406	0,406–0,510	0,545*

* Major metrical differences between the new species and *C. (Eu.) draperi.*

Types: Because of poor preservation three specimens were designated to describe this species. Syntype: WSU 30134 (Mofoka's Store, bed 1, layer 7–8); WSU 30099 and 30102 (Barkly Pass, Sta. 2A, bed 5).

Repository: Tasch Conchostracan Collection, Wichita State University, Geology Department.

Preservation: Exceptionally poor preservation showing valve configuration outlined peripherally by whitened growth bands; a few specimens (Syntypes) have more detail such as ornamentation, curvature of dorsal margin, etc.). Valves occur chiefly in green mudstone (small valves with rare large ones); and red mudstone (large valves only). Large or small valves occur in coquinas at both localities with few numbers of isolated specimens.

Discussion: Although the Mofoka conchostracans were assigned to *Cyzicus (Eu.) draperi,* the fossils at this site and in the indicated beds at Barkly Pass (see measured section and "Types" above) differ significantly from that species in several valve features as well as metrically. Both species are suboblong, but the shape of the Mofoka's Store and Barkly Pass species is variable and some forms are subovate. The position of the umbo is slightly anterior of the of the median point of the valve in *C. draperi,* in contrast to the anterior position of the new species. The dorsal margin in *C. draperi* is straight, but curved in the new species. Furthermore, the ornamentation of coarse shallow pits is unlike the granule pattern in the intervales of the new species.

There are also differences in the following parameters:
Cr/L, Ar/L, Arr/L are generally larger in *C. stockleyi,* while Ch/L and c/L are larger in *C. draperi.*
This combination of differing characteristics, both morphological and metrical, eliminate placing the Mofoka's Store and Barkly Pass species under *C. draperi.*

Asmussia loockii n. sp

(Pl. 3 figs 5–6)

Name: Named for my field associate, Johan Loock.

Description: Subovate valves with straight dorsal margin; umbo smooth above first growth line, slightly elevated above dorsal margin, subcentral, closer to anterior end; height of ventral-to-dorsal margin, posterior sector of valve, is greater than anterior sector; several double growth bands ± 15 growth bands; posterior margin more sharply curved than anterior or ventral.
Ornamentation: minute granules in contact.

Sample Size: n=2 – One left valve, mold of another left valve.

Measurements (in mm): (First figure for each parameter represents holotype; second, paratype). L– 3,5 3,8; H– 2,8 2,8; Ch– 2,2 2,5; Cr– 1,7 1,7; Av– 0,7 0,8; Arr– 0,8 1,0; a– 1,2 1,2; b– 1,3 1,4; c–1,6 1,5; H/L– 0,800 0,737; Cr/L– 0,486 0,447; Av/L– 0,200 0,211; Arr/L– 0,229 0,263; ch/L– 0,629 0,658; a/H– 0,429 0,486; b/H– 0,464 0,500; c/L– 0,457 0,395.

Types and Locality: Thabaneng, Lesotho. Tasch Station II, bed 20, unit C. Holotype, WSU No. 30052; Paratype, WSU 30053.

Repository: Tasch Conchostracan Collection. Wichita State University, Department of Geology.

Preservation: Adequate to describe major valve features. Lower anterior margin missing (equal to about the last three growth bands) (holotype); portion of dorsal margin and portion of valve on posterior slope of umbo covered; a few growth bands on anterior margin covered (paratype).

Discussion: The only estheriid at Thabaneng reported by Stockley was *Cyzicus (Eu.) draperi.* Metrically, *C. draperi* and the new species *C. loocki* are incompatible. (For data on *C. draperi* see tabulation under *C. stockleyi* on p.). Nearest to the new species are *Asmussia tuughensis* (Kobayashi and Kusumi 1953), a Cretaceous species, and *Asmussia kalinkoi* Novojilov (1958: 28 and Fig. 18), an Upper Permian species. Neither, however, has the same configuration, umbonal characters or double growth bands.

Cyzicus (Lioestheria) lesothoensis n. sp.

(Pl. 4 figs 1a–b)

Cyzicus (Eu.) draperi (Jones & Woodward) Haughton 1924

Name: Named for the southern African country of Lesotho.

Description: Ovate cyzicid with slightly curved dorsal margin that curves more sharply where it meets the anterior margin than where it meets the posterior margin; ventral margin slightly arcuate. Umbo subterminal. Ornamentation, modified hachure type. 25–26 growth bands, with last 4–9 closer together.

Sample Size: n=2

Measurements (mm): (Holotype is the first figure, followed by the paratype in each pair of figures). L– 6,0 5,6; H– 4,2 4,1; Ch– 3,7 3,7; Cr– 2,3 2,1; Av– 1,3 1,3; Arr– 1,4 1,2; a– 2,0 1,5; c–2,6 2,7; H/L– 0,683 0,750; Cr/L– 0,383 0,375; Av/L– 0,217 0,232; Arr/L– 0,233 0,214; Ch/L– 0,617 0,661; a/H– 0,488 0,357; b/H– 0,488 0,357; c/L– 0,433, 0,482.

Types and Locality: Holotype: WSU 30049B, Siberia, Sta. 3, bed 5; slightly above bed 4. Paratype: WSU 30049A, on same red shale slab as holotype.

Repository: Tasch Conchostracan Collection, Wichita State University, Department of Geology.

Preservation: Nearly complete right valve (holotype) on fragile, brittle shale and another right valve with posterior margin broken off and umbo crushed (paratype).

Discussion: This new cyzicid species is a lioestheriid having modified hachure markings (i.e. dendritic type) on intervales, and differs from *Cyzicus (Euestheria) draperi* in ornamentation. It further differs from *E. draperi* (and *Estheria stowiana,* Jones and Woodward, 1894) in other ways. (The latter species was reassigned to *Estherites draperi* by Kobayashi 1954). Its valve is neither suboblong nor with a larger distance ventral-to-dorsal on the anterior than on the posterior sector of the valve. The dorsal margin is also slightly curved in the new species, but straight in *C. draperi* and *C. stowiana* (=*draperi*).

In addition, metrical differences are as follows: a greater ratio than *C. draperi* or *C. draperi* (=*stowiana*) in: Cr/L, Av/L, Arr/L, a/H, b/H, and smaller ration in Ch/L, c/L. Taken together these differences rule out assignment to *C. draperi.* The question then arises whether there are any other species to which this lioestheriid can be assigned. Species described and/or figured by Novozhilov, Raymond, Jones, and Kobayashi differ in configuration, umbonal position, ornamentation, or metrically.

Cyzicus (Euestheria) sp. indet 1

(Pl. 4 fig. 2)

Description: Ovate euestheriid with raised polygonal ornamentation in the intervals. Thirteen widely spaced growth bands (except for last few).

Sample Size: n=1 (WSU 30037).

Measurements (mm): L– 2,1; H– 1,6; Ch– 1,0; Cr– 0,9; Av– 0,5; Arr– 0,7; a– 0,6; b– 0,7; c– 1,0; H/L 0,762; Cr/L– 0,429; Av/L– 0,238; Arr/L– 0,333; Ch/L–0,476; a/H– 0,375; b/H– 0,478; c/L– 0,476.

Locality: Thabaneng, Lesotho, bed 19, Lower B.

Repository: Tasch Conchostracan Collection, Wichita State University, Department of Geology.

Discussion: This species differs from *C. (Eu.) draperi* metrically in having a greater ratio in all parameters except Ch/L and c/L, which are smaller, and an overlap with the ratio for b/H.

Paleolimnadia (Grandilimnadia) sp. indet.

(Pl. 4 fig. 3).

Description: Ovate right valve with length greater than height; prominent elliptical umbonal area; more than six growth bands that increase in separation ventrally; growth bands deeply incised at margins giving a rugose appearance.

Sample Size: n=1 (WSU 30097).

Measurements (mm): L– 2.5; H– 1,7; H/L– 0,68; length of umbo– 0,05; height of umbo– 0,05; h/l– 0,33.

Locality: Thabaneng, Lesotho. Bed 16 "detail" (31–24mm).

Discussion: Incomplete preservation of ventral and posteroventral margins preclude exact determination of the species.

Conchostraca

Incertae Sedis

(Pl. 4 fig. 8)

A large, eccentrically ovate valve with huge umbo and few to numerous growth bands marginal to umbo. Dorsal margin is slightly curved. Unfortunately there are no complete specimens, although numerous fragmentary valves are at hand. This conchostracan may be the equivalent of a eulimnadiid (i.e. a "paleoeulimnadiid") or some other new genus. More study and an attempt to split samples for further search of more complete specimens, is indicated. Locality: Siberia, Sta. 1A, bed 4. WS 30200.

Insecta

Order Coleoptera

(Pl. 4 fig. 4)

(Order Coleoptera, Haughton 1924: 330, fig. 1)

A beetle elytron, L=7,0mm, H=1,6mm; number of rows = 15, number of pustules (tubercles) per row (estimated ± 60). Locality: Siberia, Station 1A, bed 10. WSU 30065.

Order Orthoptera

Family Gryllidae

(Pl. 4 fig. 5)

(Family Gryllidae; *Archaegryllodes strombergensis* Haughton 1924: 336–337, fig. 5)

A cricket with stridulating organ preserved; L=14,0 mm; length of small leg = 9,5 mm. Locality: Siberia, Station 1A, bed 6. WSU 30056.

Order Ephemeroptera

(Pl. 4 fig 6)

(Order Plecoptera; Family Ephemeridae *Phthartus africanus* Haughton 1924: 331, fig. 2)

Mayfly nymphs with three long tails (cerci) and plumose gills margining the abdomen, of which segments are preserved. Length of abdomen: 7,0 mm; width of abdomen: 2,5 mm tapering to 0,7 mm posteriorly. Cerci incomplete posteriorly. Locality: Siberia, Station 1A, bed 11. WSU 30099.

Order Orthoptera

Pl. 4 fig. 7

(Order Orthoptera, Family Mesoblattinidae, *Striatotegmen africanum* Haughton 1924: fig. 3)....

A blattid wing. Length = 4,9 =mm; width: 2,8+mm. Locality: Siberia, Station 1A, bed 6 "C". WSU 30017. Also occurs in bed 4.

Notostraca

Lepidurus stormbergensis Haughton 1924

(*Lepidurus stormbergensis* Haughton, Barnard 1931: 229, fig. 22)

Very poorly preserved material, not photographed by Haughton or Barnard. Abdomen with 7+ body rings bearing numerous short spines on dorsal side. Short telson ending in a spatulate, supra-anal plate between two long tapering caudal filaments (rami). Length of abdomen, 6,0 mm; length of supra-anal plate, 1,2 mm; length of one caudal filament, 6,2 mm + (ends eroded); another caudal filament represented by upper 2,2 mm. Locality: Siberia, Station 1E, bed 1. WSU 30088. (For other beds with poorly preserved material of this species, see Siberia section).

Other fossils

There are several additional species of conchostracans and a few other fossils requiring further study. They will be described elsewhere.

Acknowledgements

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Johan Loock provided invaluable field help, from smoothing the way through RSA and Lesotho customs and with the local people at various places to participating in the active search for conchostracan fossils. His knowledge of Clarens Formation geology and of the African literature were also assets for this project. I am indebted to Johan for varied field assistance, his warm fellowship and his ready cooperation in the field which I hereby gratefully acknowledge.

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APPENDIX 1

CONCHOSTRACAN GENERA AND SPECIES IN THE KAROO ROCKS OF SOUTHERN AFRICA

(Data from Paul Ellenberger, 1970)

ZONE NO.	DESCRIPTION	SITES	GENUS AND SPECIES
C/2	Drakensberg lavas; 2nd ash interbed	Leloaleng	*Estheria* cf. *drakensbergi*
C/1	Base of Drakensberg lava "Jusque vers + 50m."	Mooti-Tlali	*Estheria* sp. (similar to *Estheria* sp. of Zone B/6
B/7	Cave Sandstone (Upper)	Wonderkop	*Estheria* sp.
B/6	Cave Sandstone (Middle)	Matelile Nkoakhoma	*Estheria* sp. *Estheria* cf. *browni*
B/4	Cave Sandstone (Basal)	Cana Mohaleshoek Cana Siberia	*Estheria (Cyzicus) draperi* *Estheria stowiana* *Estheria* sp.
B/3	Transition bed III(or upper Red Beds "c" or Basal Cave Sandstone	Mohaleshoek Makoloane Makoloane Thabana-Morena Cana	*Estheria (Cyzicus) mangliensis* *Estheria draperi*
B/1	Transition beds I or Red Beds, Middle; or Red Beds, Upper	Brakfontein Makoloane	*Estheria* *Estheria*

Plate 1

Barkly Pass Section (S.Africa):

Fig. 1 Johan Loock points to wall fault in massive Clarens Formation.

Fig. 3 The dark, thin conchostracan-bearing layer is green mudstone.

Thabaneng Section (Lesotho):

Fig. 2 Massive Cave Sandstone, the base of the measured section.

Fig. 4 The rest of the measured section including four major fossil occurrences.

Plate 2

Mofoka's Store Section (Lesotho):

Fig. 1 View of SW spur of hill bearing conchostracan beds.

Fig. 2 Basal conchostracan beds between fibrous calcite layers (small white flags).

Fig. 3 Capping massive Cave Sandstone and siltstone-mudstone sequence immediately underlying it.

Siberia Section (S. Africa):

Fig. 4 View of farm from outcrop (see Textfig. 1) and surrounding topography.

Fig. 5 Measured section, showing vegetation cover.

Plate 3

Cornia haughtoni n. sp.

Fig. 1a Right valve, subterminal umbonal node.

Fig. 1b Same specimen before cleaning, enlarged to show node. Holotype WSU 30067.
Thabaneng, Lesotho, Station 2, bed 16 (Upper). L = 2,1mm.

Fig. 2 Left valve of another corniid, umbonal node displaced by flattening. Paratype, WSU 30068.
Thabaneng Station 2, bed 18 (lower), L = 1,4mm.

Cyzicus (Euestheria) stockleyi n.sp.

Fig. 3 One of three syntype specimens, WSU 30134, Mofoka's Store, Lesotho. Bed 1, fibrous calcite layer 7–8.

Fig. 4 Barkly Pass, R.S.A. WSU 30102. Station 2A, bed 5. L = 15,7 mm.

Asmussia loockii, n.sp.

Fig. 5 Left valve. Note straight dorsal margin and subcentral postion of umbo. Holotype, Thabaneng, Station 2, bed 20, unit C, L = 3,2 mm WSU 33052.

Fig. 6 Paratype, same locality, L = 3,5 mm WSU 30053.

Plate 4

Cyzicus (Lioestheria) lesothoensis. n.sp.

Fig. 1a Left valve. Holotype. WSU 30049B. Note slightly curved dorsal margin. Siberia, R.S.A., Tasch Station, 1A, bed 5, (slightly above bed 4), L = 6,0 mm.

Fig. 1b Paratype, WSU 30049A, same slab as holotype, L = 5,6 mm.

Fig. 2 *Cyzicus (Euestheria)* sp. indet. 1.
Left valve. Thabaneng, Station 2, bed 18, lower B, L = 2,1 mm. WSU 30037

Fig. 3 *Paleolimnadia (Grandilimnadia)* sp. indet.
Right valve. Note comparatively large elliptical umbo and deeply incised growth bands. Thabaneng, Station 2, bed 16 "detail" (31–24 mm), L = 2,5 mm. WSU 30097.

Fig. 4 Order Coleptera. Beetle elytron. L = 17,0 mm Siberia, Tasch Station 1A, bed 10, WSU 30065.

Fig. 5 Family Gryllidae. Cricket; note stridulating organ. L = 14,0 mm Siberia, Tasch Station 1A, bed 6, WSU 30056.

Fig. 6 Order Ephemeroptera. Mayfly, nymph with three long tails and plumose gills on sides of abdominal segments. L = 7,0 mm.

Fig. 7 Order Orthoptera. A blattid wing. L = 4,9 mm. Siberia, Tasch Station 1A, bed 6 "C", WSU 30087.

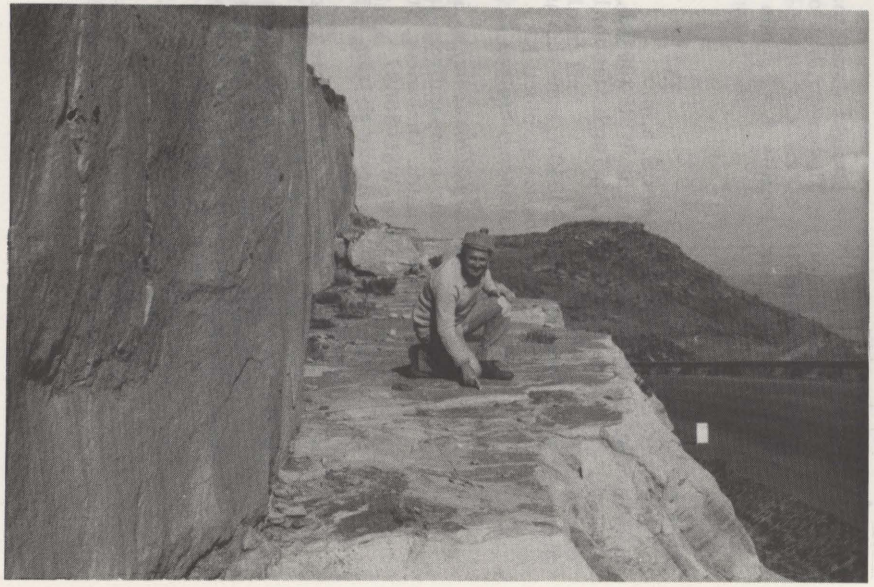
Fig. 8 Conchostraca, *incertae sedis.*
Note large area of valve occupied by the umbo. L = 9,2mm
WSU 30200.

1

2

Plate 1

3



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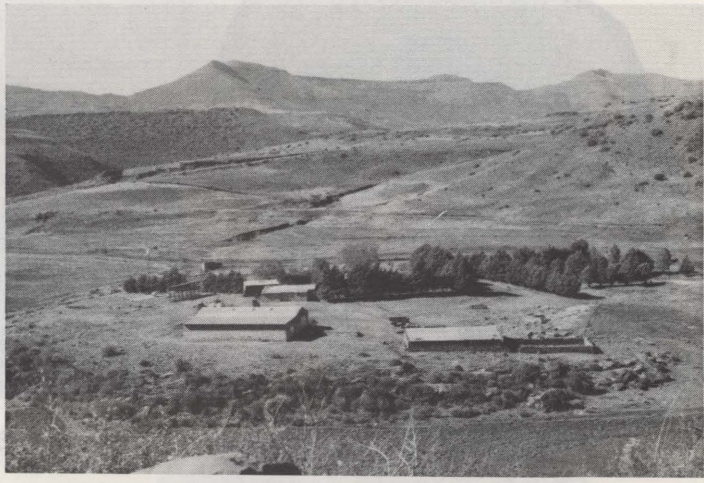

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Plate 2

1B

2

4

1A

3

6

Plate 3

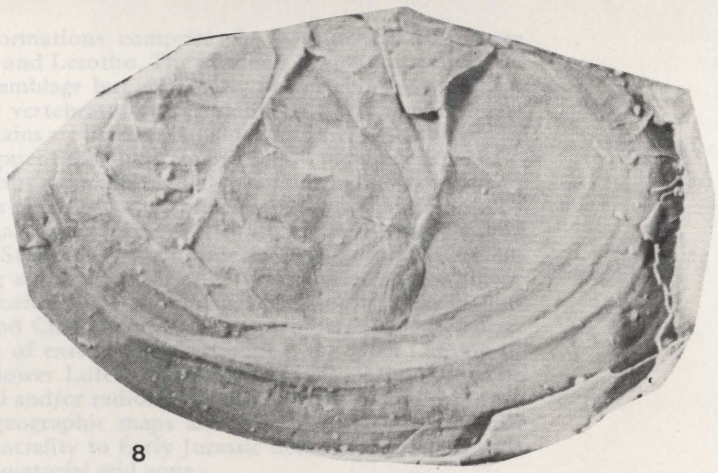
5

Plate 4

1A

1B

2



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