

Ostracod faunas from the Halul, Laffan and Nahr Umr Formations of offshore Abu Dhabi, U.A.E.

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ABSTRACT — The Halul and Laffan (Coniacian), and Nahr Umr (Albian) Formations of offshore Abu Dhabi are dated using palynomorphs, foraminifera and nannofossils and their ostracod faunas are illustrated and compared with similar assemblages in the Middle East.

INTRODUCTION

This is the first occasion on which the Cretaceous ostracod faunas of Abu Dhabi have been illustrated, despite their use for many years as biostratigraphic indices in the S. Arabian Gulf area and despite numerous references to them in unpublished oil company reports.

Ostracods with regional stratigraphic value are found at three levels in the Cretaceous of offshore Abu Dhabi

(see Fig. 1 for location area). The Halul, Laffan and Nahr Umr Formations each yield distinctive ostracod faunas which compare well with time equivalent assemblages in other parts of the Middle East. The age significance of each of these faunas in Abu Dhabi has been determined by calibration of their occurrences against nannofossil, palynomorph and foraminiferal distributions (see Fig. 2).

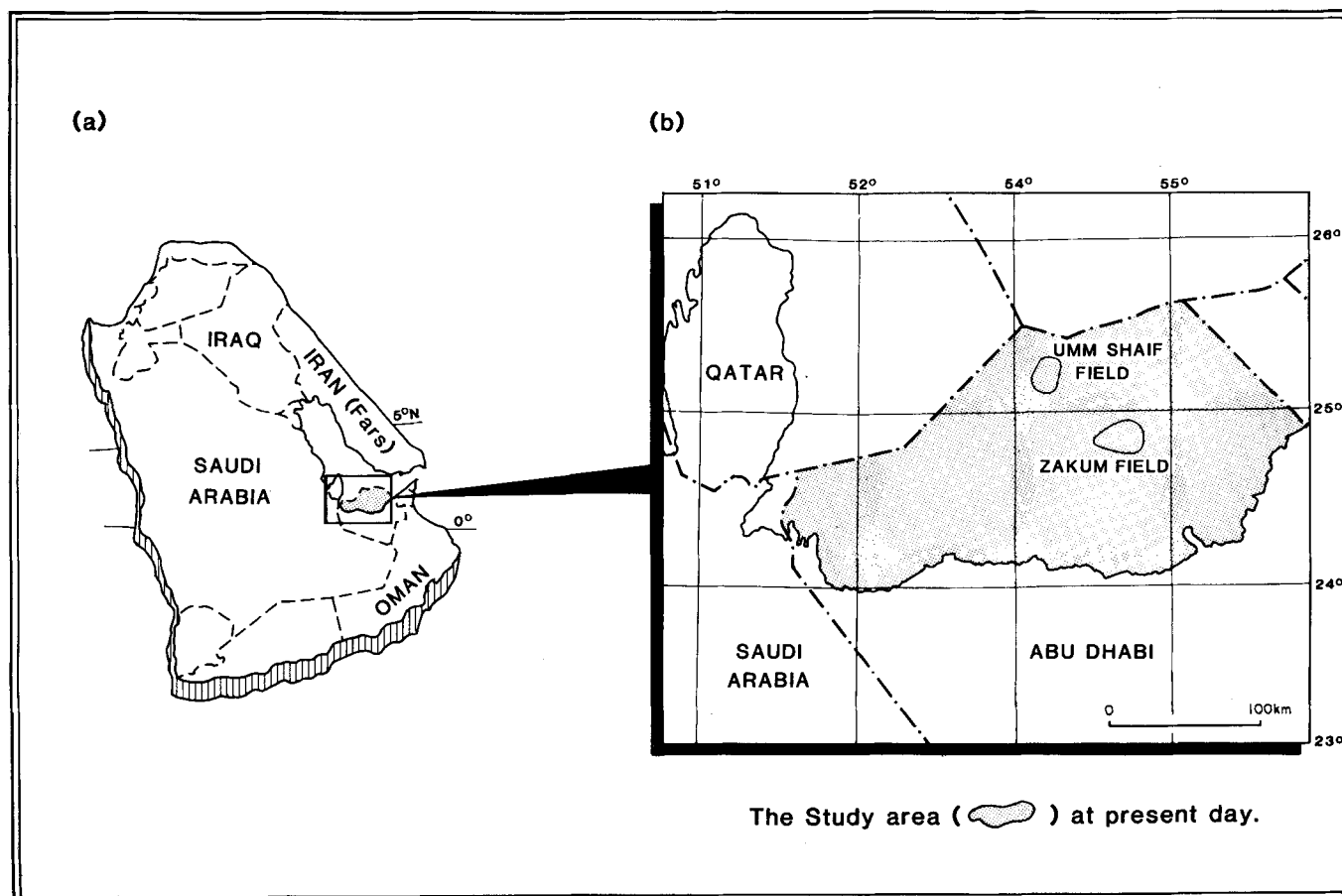


Fig. 1. The Arabian Plate showing approximate palaeolatitudes for the 'Mid' Cretaceous.



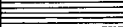
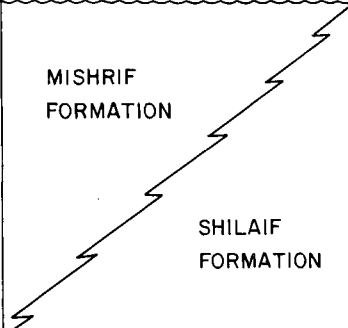
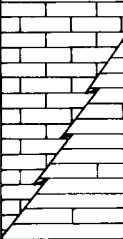
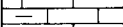

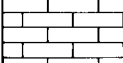
| AGE | LITHOSTRATIGRAPHY | | LITHOLOGY | BIOSTRATIGRAPHY |
|-------------------------|-------------------|--|---|---|
| | GROUP | FORMATION | | |
| Santonian | ARUMA GROUP | FIQA FM (lower part) |  | Lucianorhabdus cayeuxii, Broinsonia signata Marginotruncana sinuosa, M. sigali, Dicarinella canaliculata, D. concavata |
| Coniacian | | HALUL FORMATION |  | Whiteinella archeocretacea, M. renzi, Dicarinella imbricata |
| | | LAFFAN FORMATION |  | Xenascus ceratioides, Coronifera oceanica Hystriochodium pulchrum, Canningia reticulata Mehesella IRC23, Brachycythere IRJ10 (lower part only) |
| (Early-Middle) Turonian | WASIA GROUP |  MISHRIF FORMATION |  | Ovocytheridea AUR1496, O. IRJ5 Brachycythere IRJ9, B. IRE10 Cytherella posterosulcata, Cythereis IRE1, Veenia IRE8, Buntonia IRE9, B. IRC33 Palaeohystriochophora infusorioides Cannosphaeropsis utinensis, Micula stauraphora |
| Cenomanian | | | | SHILAIF FORMATION |
| | | MAUDDUD equivalent |  | Mischrif Fm: Ovalveolina ovum, Praevalveolina cretacea |
| Albian | | NAHR UMR FORMATION |  | Shilaif Fm: Favosella washtensis, Rotalipora sp., Praeglobotruncana stephani |
| | SHUAIBA FM (part) | |  | Planomulina buxtorfi Glenocythere reticulata, Schuleridea cf. baidarensis Veeniacythereis streblolophata, Metacytheropteron IRC 10, "Dordoniella" IRJ 15 Subtilisphaera cheit, Odontochitina costata, Xiphophoridium alatum Stephodinium coronatum, Dinopterygium cladoides Prediscosphaera cretacea, Parabdolithus achlyostaurion |

Fig. 2. Stratigraphic distribution of ostracods and key foraminifera, palynomorphs and nannofossils from the Cretaceous succession, offshore Abu Dhabi.

Explanation of Plate 1

All specimens are $\times 75$

Figs. 1, 2. "*Mehesella*" cf. IRC23 Grosdidier: fig. 1, right view; fig. 2, dorsal view. Halul Formation.

Figs. 3-6. "*Mehesella*" IRC23 Grosdidier: fig. 3, right view of ?male dimorph; fig. 4, dorsal view of ?male dimorph; fig. 5, left view of ?male dimorph; fig. 6, left view of ?female dimorph. Halul Formation.

Figs. 7, 8. *Veenia* IRD7 Grosdidier: fig. 7, left view; fig. 8, right view. Laffan Formation.

Figs. 9, 10. ?*Limburgina* IRH31 Grosdidier: fig. 9, right view; fig. 10, dorsal view. Laffan Formation.

Fig. 11. Indet. gen. et sp. ABU1, right view. Laffan Formation.

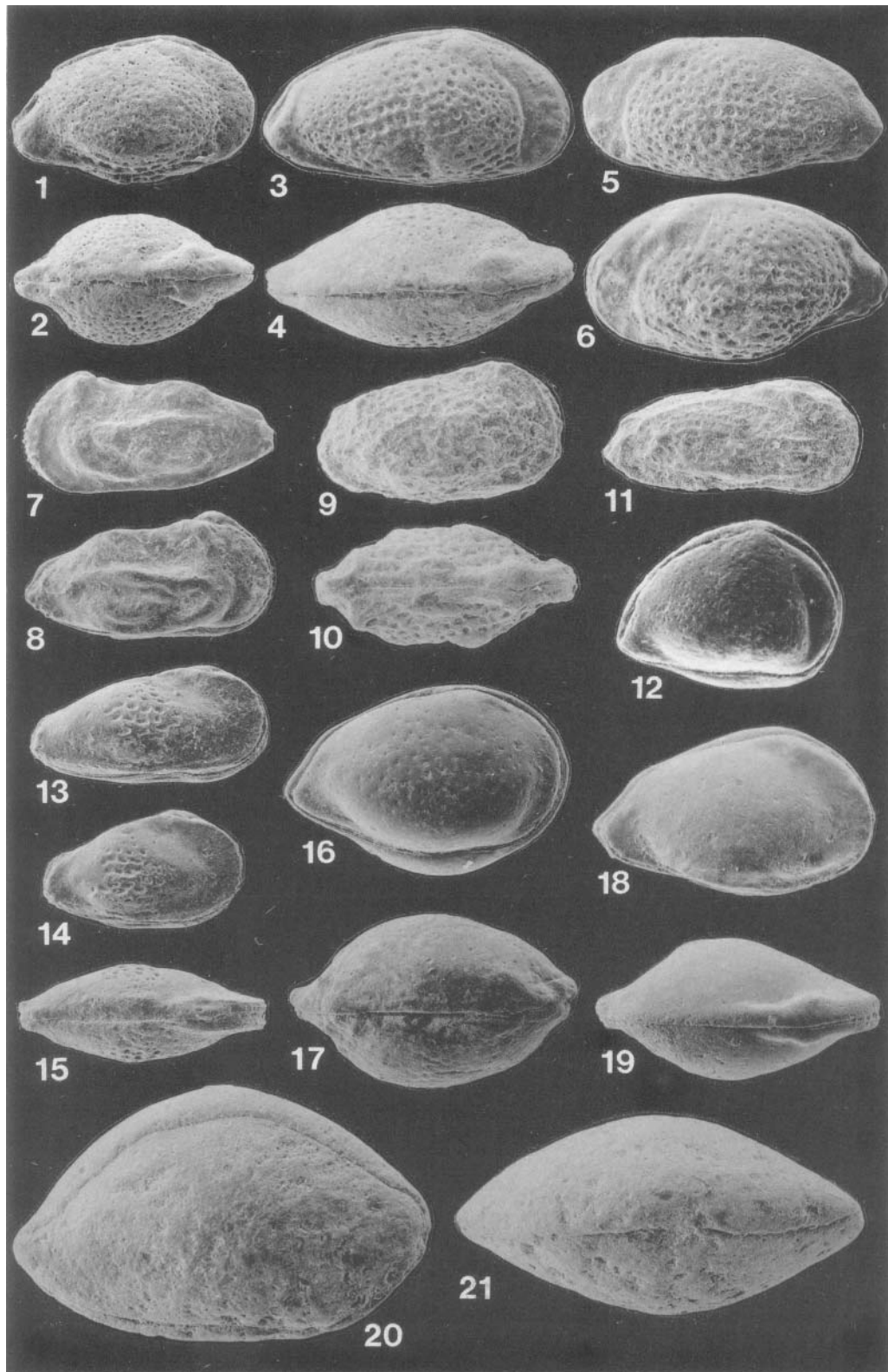
Fig. 12. *Brachycythere* IRJ10 Grosdidier, right view. Halul Formation.

Figs. 13-15. *Buntonia* cf. OMN6 Athersuch: fig. 13, right view of ?male dimorph; fig. 14, right view of ?female dimorph; fig. 15, dorsal view of ?male dimorph. Laffan Formation.

Figs. 16, 17. *Brachycythere* IRJ9 Grosdidier: fig. 16, right view; fig. 17, dorsal view. Laffan Formation.

Figs. 18, 19. *Pterygocythere* IRD8 Grosdidier: fig. 18, right view; fig. 19, dorsal view. Laffan Formation.

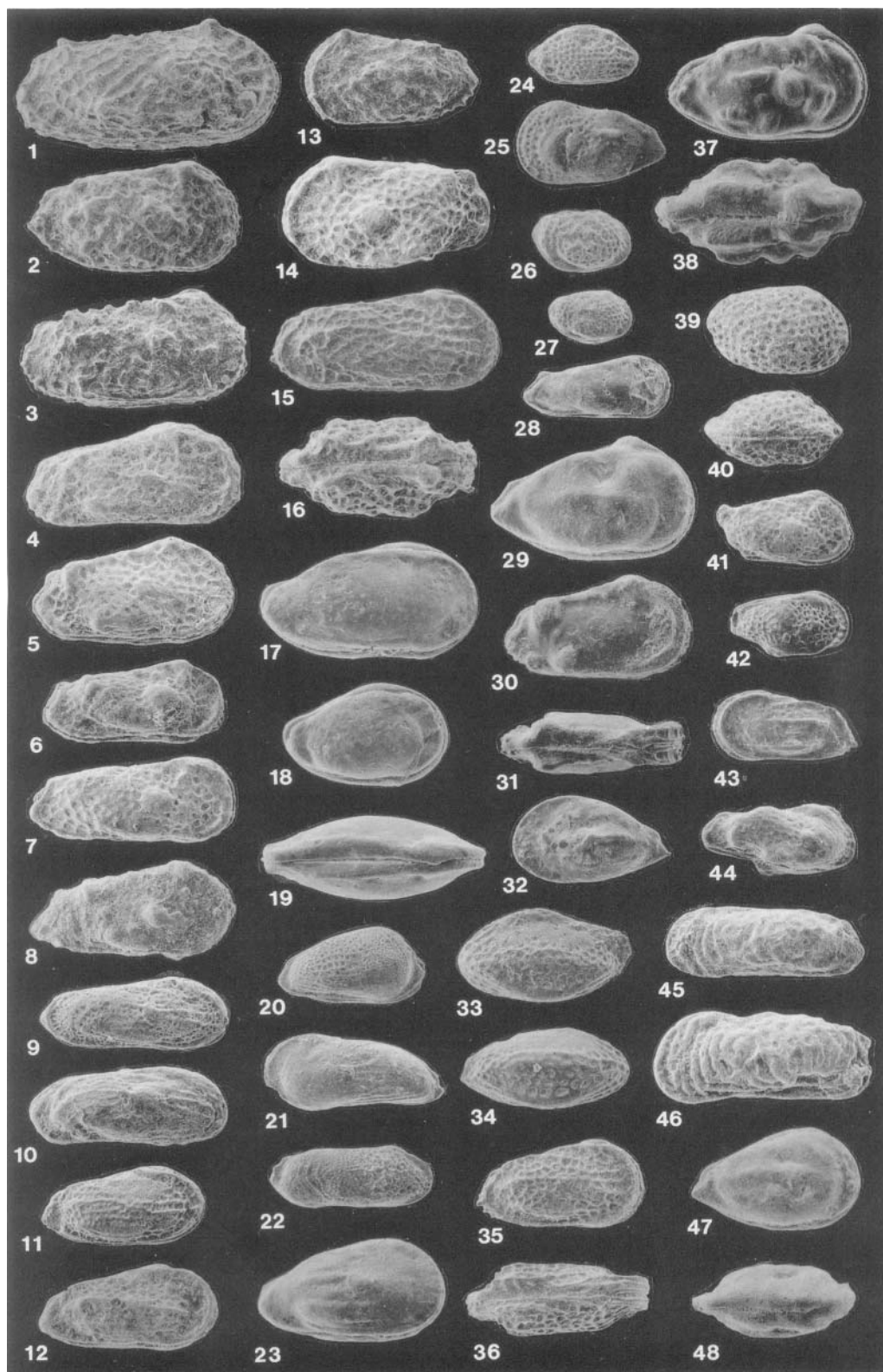
Figs. 20, 21. *Bairdia* cf. IRB35 Grosdidier: fig. 20, right view; fig. 21, dorsal view.



Explanation of Plate 2

All specimens are $\times 75$

- Fig. 1. Indet. gen. et sp. ABU2, right view. Laffan Formation.
- Figs. 2, 16. "*Echinocythereis*" IRJ6 Grosdidier: fig. 2, right view; fig. 16, dorsal view. Laffan Formation.
- Figs. 3, 13. "*Echinocythereis*" IRJ6 Grosdidier: fig. 3, right view; fig. 13, left view. Laffan Formation.
- Fig. 4. Indet. gen. et sp. ABU3, right view. Laffan Formation.
- Fig. 5. Indet. gen. et sp. ABU4, right view. Laffan Formation.
- Fig. 6. Indet. gen. et sp. ABU5, right view. Laffan Formation.
- Fig. 7. Indet. gen. et sp. ABU6, right view. Laffan Formation.
- Fig. 8. Indet. gen. et sp. ABU7, right view. Laffan Formation.
- Fig. 9. Indet. gen. et sp. ABU8, right view. Laffan Formation.
- Fig. 10. Indet. gen. et sp. ABU9, right view. Laffan Formation.
- Fig. 11. Indet. gen. et sp. ABU10, right view. Laffan Formation.
- Fig. 12. *Dumontina* cf. IRE18 Grosdidier, right view. Laffan Formation.
- Fig. 14. ?*Limburgina* IRH31 Grosdidier, left view. Laffan Formation.
- Fig. 15. *Dumontina* cf. IRE18 Grosdidier, right view. Laffan Formation.
- Figs. 17-19. *Buntonia* IRE9 Grosdidier: fig. 17, right view of ?male dimorph; fig. 18, right view of ?female dimorph; fig. 19, dorsal view of ?male dimorph. Laffan Formation.
- Fig. 20. Indet. gen. et sp. ABU11, right view. Laffan Formation.
- Fig. 21. "*Metacytheropteron*" IRR24 Grosdidier, left view. Laffan Formation.
- Fig. 22. Indet. gen. et sp. ABU12, right view. Laffan Formation.
- Fig. 23. *Buntonia* cf. IRC33 Grosdidier, right view. Laffan Formation.
- Fig. 24. ?*Hemicytherura* sp., right view. Laffan Formation.
- Fig. 25. Indet. gen. et sp. ABU13, left view. Laffan Formation.
- Fig. 26. Indet. gen. et sp. ABU14, right view. Laffan Formation.
- Fig. 27. Indet. gen. et sp. ABU15, right view. Laffan Formation.
- Fig. 28. Indet. gen. et sp. ABU16, right view. Laffan Formation.
- Fig. 29. *Veenia* cf. IRD17 Grosdidier, right view. Laffan Formation.
- Figs. 30, 31. "*Planileberis*" cf. IRO16 Grosdidier: fig. 30, right view; fig. 31, dorsal view. Laffan Formation.
- Fig. 32. *Veenia* sp., left view. Laffan Formation.
- Figs. 33, 34. *Metacytheropteron* IRL3 Grosdidier: fig. 33, left view; fig. 34, right view. Laffan Formation.
- Figs. 35, 36. *Dumontina* cf. IRE18 Grosdidier: fig. 35, right view; fig. 36, dorsal view. Laffan Formation.
- Figs. 37, 38. *Cythereis* IRE12 Grosdidier: fig. 37, right view; fig. 38, dorsal view. Laffan Formation.
- Figs. 39, 40. Indet. gen. et sp. ABU17: fig. 39, right view; fig. 40, dorsal view. Laffan Formation.
- Fig. 41. Indet. gen. et sp. ABU18, right view. Laffan Formation.
- Fig. 42. Indet. gen. et sp. ABU19, right view. Laffan Formation.
- Fig. 43. Indet. gen. et sp. ABU20, right view. Laffan Formation.
- Fig. 44. Indet. gen. et sp. ABU21, right view. Laffan Formation.
- Figs. 45, 46. Indet. gen. et sp. ABU22, left views (of two dimorphs?). Laffan Formation.
- Figs. 47, 48. *Veenia* IRE8 Grosdidier: fig. 47, right view; fig. 48, dorsal view. Laffan Formation.



The faunas of the Halul and Laffan Formations illustrated herein are best compared with those described by Grosdidier (1973) from Iran. The Nahr Umr faunas are more widely distributed along the mid-Cretaceous southern Tethyan shelf and are known from many N. African, Levantine and Middle Eastern localities. The distribution of these faunas is reviewed by Athersuch (1985, in press).

Plates 1-4 depict most of the ostracods recovered from the three formations in offshore Abu Dhabi. None of the species have been formally described, and previously undescribed species (prefixed ABU) have been left in open nomenclature as, due to the proprietary nature of the material, the exact provenance of individual specimens cannot be revealed. For the Halul and Laffan Formations, most specimens were recovered from core samples, a few from ditch cuttings. The Nahr Umr material comprised ditch cuttings alone.

THE OSTRACOD FAUNAS

The Halul Formation

The Halul Formation has been dated as Coniacian in age throughout the region on the basis of the planktonic foraminifera *Whiteinella archaeocretacea*, *Marginotruncana renzi* and *Dicarinella imbricata* and the dinoflagellate cysts *Xenascus ceratioides*, *Coronifera oceanica*, *Hystriosphera pulchrum* and *Canningia reticulata*. The lower part of this formation, which is developed in a marine 'reefal' lime-mud facies, is characterised by the ostracoda *Brachycythere* spp. (including *B. IRJ10* Grosdidier) and "*Mehesella*" spp. (including '*M. IRC23* Grosdidier). The former species has a Coniacian age range in Iran, but '*M. IRC23*' is apparently

restricted to the Santonian there (Grosdidier, 1973).

The Laffan Formation

The Laffan Formation is dated as Coniacian by the occurrence of the dinoflagellate cyst *Cannosphaeropsis utinensis* and by the nannofossil *Micula staurophora*. Shallow marine shales within the formation yielded large and diverse assemblages of ostracods. Over 30 species were recorded in the offshore Abu Dhabi area. Many of these are previously undescribed forms, but some are known from the Coniacian Laffan Formation of Iran (Grosdidier, 1973). The principal indices of this formation are *Cythereis* IRE12 Grosdidier, *Brachycythere* spp. (*B. IRJ9*, *B. IRE10* Grosdidier), *Ovocytheridea* AUR1496 Grekoff, *Buntonia* spp. (*B. IRE9*, *B. IRC33* Grosdidier) and *Veenia* IRE8 Grosdidier. Other previously recorded species found in this formation are *Veenia* IRE17 Grosdidier, *?Limburgina* IRH31 Grosdidier, *?Dumontina* cf. IRE18 Grosdidier, *Metacytheropteron* IRC3 Grosdidier, *M. IRR24* Grosdidier, '*Planileberis*' cf. IRO16 Grosdidier, *Ovocytheridea* IRJ5 Grosdidier and *Cophinia* cf. IRE12 Grosdidier. All of these species have been recorded from the Coniacian Laffan Formation in Iran by Grosdidier. In addition, *Cytherella posterosulcata* Al-Abdul-Razzaq, previously recorded from the Santonian and Coniacian throughout the Middle East (Athersuch, 1985) was also recovered.

There are insufficient data to determine precisely the palaeoenvironmental significance of most of the species recovered from the Laffan Formation. However, it is presumed that the great variation in faunas from one locality to another observed in the offshore Abu Dhabi area reflects facies control. In this respect it is

Explanation of Plate 3

All specimens are $\times 75$

Fig. 1. *Paracypris* sp., right view. Laffan Formation.

Figs. 2-4. *Cytherella* sp.: fig. 2, left view; fig. 3, right view; fig. 4, dorsal view. Laffan Formation.

Figs. 5-7. *Cytherella posterosulcata* Razzaq: fig. 5, right view; fig. 6, left view; fig. 7, dorsal view. Laffan Formation.

Figs. 8, 9. *?Cophinia* IRE12 Grosdidier: fig. 8, right view; fig. 9, dorsal view. Laffan Formation.

Fig. 10. Indet. gen. et sp. ABU23, right view. Laffan Formation.

Fig. 11. *Cytherella* sp., left view. Laffan Formation.

Fig. 12. *?Pontocyprilla* sp., left view. Laffan Formation.

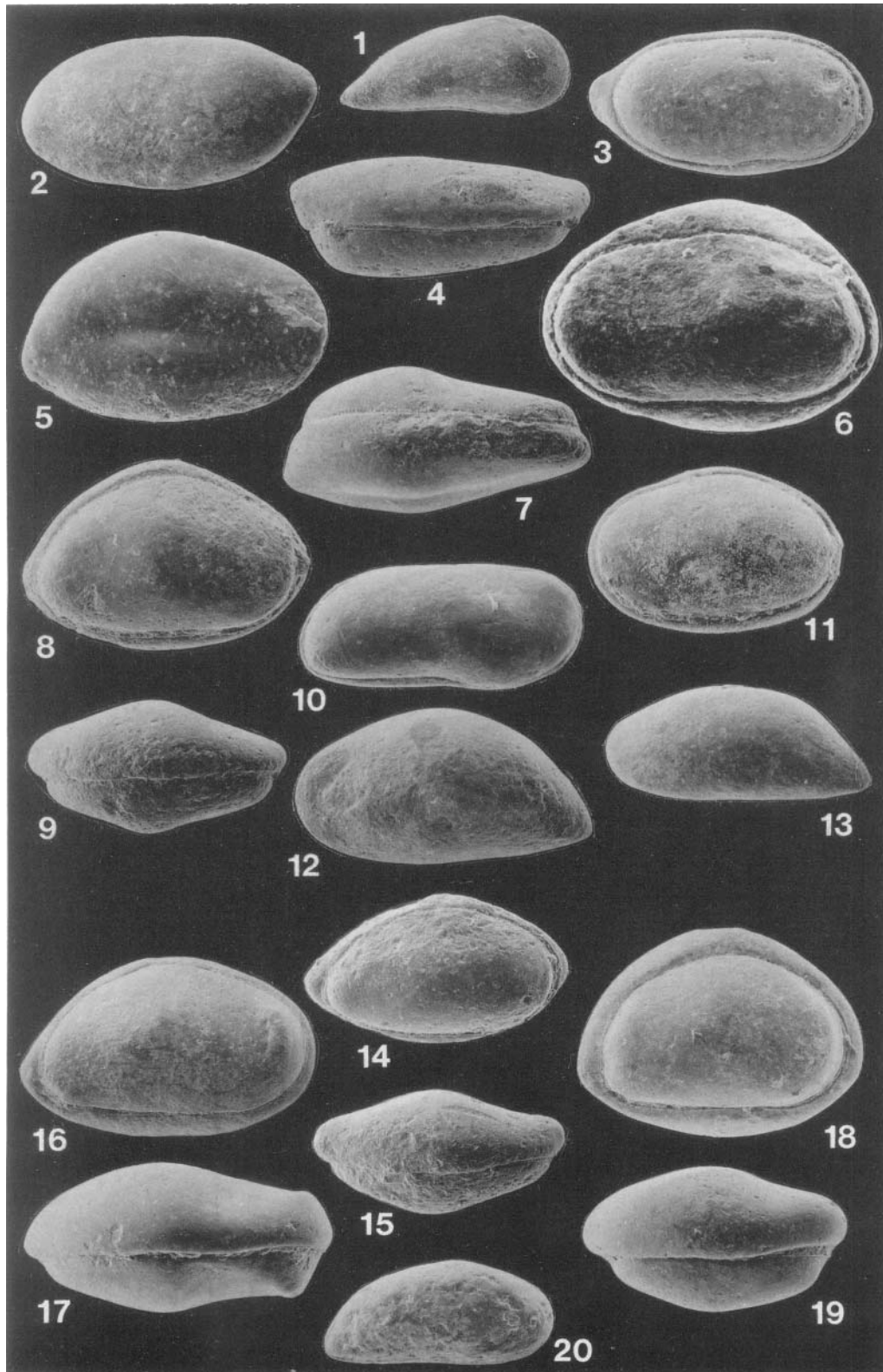
Fig. 13. *?Macrocypsis* sp., left view. Laffan Formation.

Figs. 14, 15. *?Cophinia* cf. IRE12 Grosdidier: fig. 14, right view; fig. 15, dorsal view. Laffan Formation.

Figs. 16, 17. *Ovocytheridea* AUR1469 Grekoff: fig. 16, right view; fig. 17, dorsal view. Laffan Formation.

Figs. 18, 19. *Ovocytheridea* IRJ5 Grosdidier: fig. 18, right view; fig. 19, dorsal view. Laffan Formation.

Fig. 20. *Pontocyprilla* sp., right view. Laffan Formation.



interesting to note that most of the 'indeterminate' taxa recorded herein are from the flanks of a basin which existed in the offshore area during Laffan times. This suggests that endemic faunas developed in marginal marine areas at this time. In basinal areas, taxa with regional affinities were more frequently recovered.

Nahr Umr Formation

The transgressive marine shales of the Nahr Umr are dated as Albian in the offshore Abu Dhabi area on the basis of the nannofossils *Prediscosphaera cretacea*, *Parhabdolithus achlyostaurion* and the palynomorphs *Subtilisphaera cheit*, *Xiphophoridium alatum*, *Dinopterygium cladoides*. The occurrence of the planktonic foraminifer *Planomalina buxtoni* (latest Albian) in the overlying Maaddud equivalent also supports an age no younger than Albian for this formation. This age assignment is consistent with the age previously determined for this formation in other parts of the Middle East.

Characteristic ostracod species for this formation are *Glenocythere reticulata* Razzaq, *Veeniacythereis streblolophata* Razzaq, *Schuleridea* cf. *baidarensis* (Damotte & St. Marc), *Schuleridea* IRJ15 (Grosdidier) and *Metacytheropteron* IRC10 Grosdidier. Of these species, *S. baidarensis* and *M. IRC10* are known only from Albian sediments in the Middle East, *V. streblolophata* has previously been recorded only from the Early

Cenomanian and *G. reticulata* has a documented Albian to Early Cenomanian age range (Athersuch, 1985).

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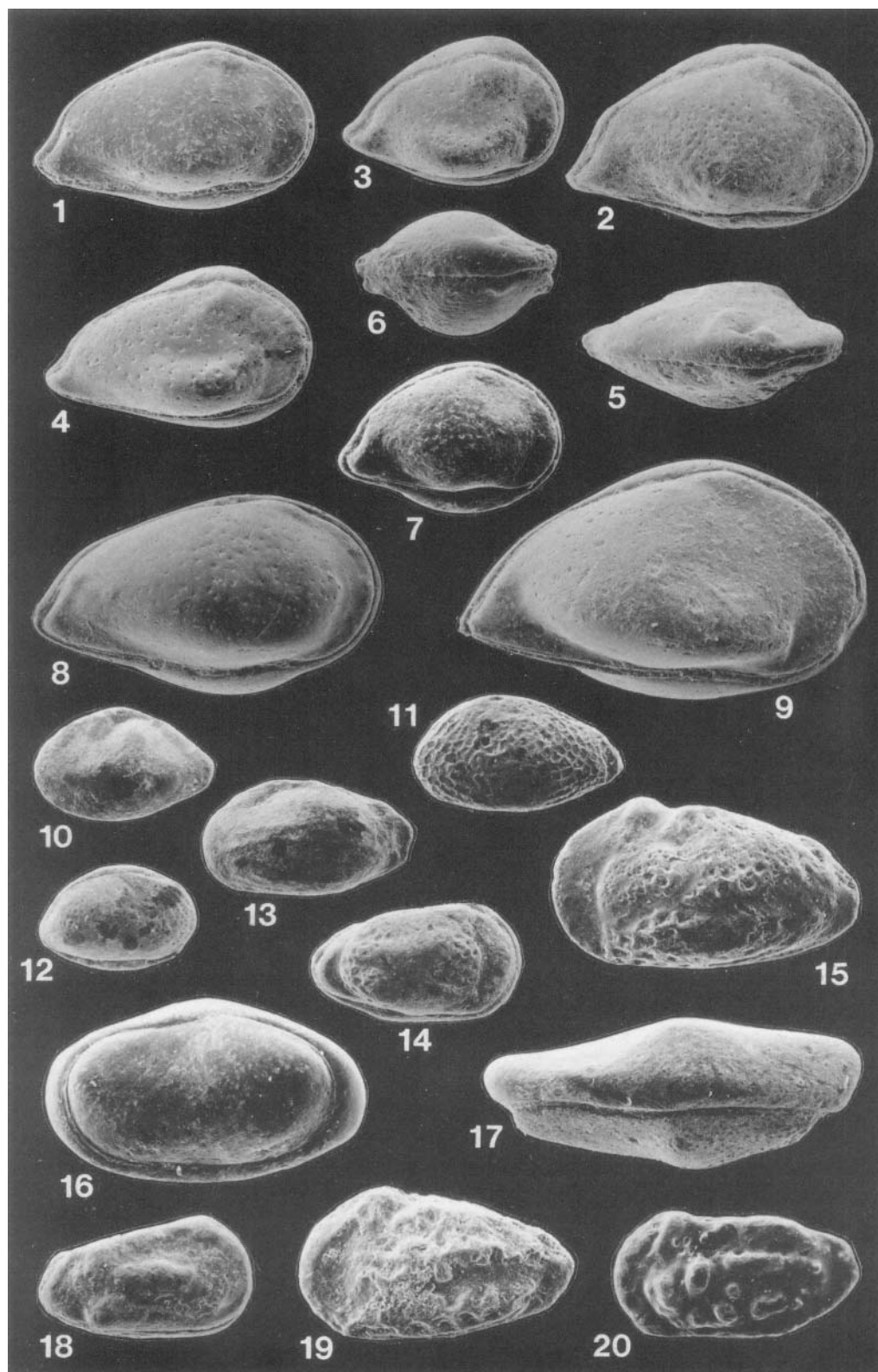
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Revised manuscript accepted September 1985

Explanation of Plate 4

All specimens are $\times 75$

- Figs. 1, 2, 6, 7. *Brachycythere* IRJ9 Grosdidier: figs. 1, 2, right views of ?male dimorphs; fig. 6, dorsal view of ?female dimorph; fig. 7, right view of ?female dimorph. Laffan Formation.
- Figs. 3-5. *Brachycythere* IRE10 Grosdidier: fig. 3, right view of ?female dimorph; fig. 4, right view of ?male dimorph; fig. 5, dorsal view of ?female dimorph. Laffan Formation.
- Fig. 8. *Brachycythere* cf. IRJ9 Grosdidier, right view. Laffan Formation.
- Fig. 9. *Brachycythere* sp., right view. Laffan Formation.
- Fig. 10. *Schuleridea* cf. *baidarensis* (Damotte & St. Marc), left view. Nahr Umr Formation.
- Fig. 11. Indet. gen. et sp. ABU24, left view. Nahr Umr Formation.
- Fig. 12. ?*Schuleridea* sp., right view. Nahr Umr Formation.
- Fig. 13. *Metacytheropteron* IRC10 Grosdidier, left view. Nahr Umr Formation.
- Fig. 14. Indet. gen. et sp. ABU25, right view. Nahr Umr Formation.
- Fig. 15. *Glenocythere reticulata* Razzaq, left view. Nahr Umr Formation.
- Figs. 16, 17. *Cytherella* cf. IRC6 Grosdidier: fig. 16, right view; fig. 17, dorsal view. Nahr Umr Formation.
- Fig. 18. *Cythereis* sp., right view. Nahr Umr Formation.
- Fig. 19. *Veeniacythereis streblolophata* Razzaq & Grosdidier, left view. Nahr Umr Formation.
- Fig. 20. *Cythereis* IRE12 Grosdidier, left view. Laffan Formation.



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