On the day of arrival (Aug. 18th) the Spanish iris had formed 4 or 5 foliage leaves, the English one averagely 7—8. In the course of months (Table 1, 4th and 7th column) we see that the Spanish iris has formed 6 or 7 foliage leaves and the English one 8. Further we clearly observe from the stretching of the foliage leaves already in winter that the Spanish iris (Table 1, 3rd column) is in advance of the English one (Table 1, 6th column) and will blossom first. These flowering-dates are found in table 2. In table 2 the dates of flower-formation, divided into stages, of the 3 irises may be compared. The formation of the Spanish iris is somewhat later than that of Imperator, the flower-formation of the English iris is a little after that date. We can best observe this difference if we look at the dates of the first beginning, viz. Febr. 1st. The variations then found remain on the successive dates.

Of Iris Imperator the dates of flower-formation of 1933, '34, '35 and '36 were compared. 1933 and '34 hardly deviate from each other (47—50, communication 43). In 1935 (Table 3), in spite of the fact that the same preparatory treatment has been applied, the flower-formation is already in full progress on Febr. 1st (Stage IV). In 1933 this was not attained till the middle of March, in '34 after March 16th. Here also, as in comm. 43, a graphic (fig. 7) has been made of the temperature zone in the ground 10 cm deep. The temperature in December '34 is much higher than in the two preceding years. In order to study these external influences, bulbs from Heemskerkerduin (N.-Holland) and Haamstede (Zeeland) were compared. Those from Zeeland are more than 2, probably 3 weeks ahead of those of N.-Holland (Table 4) and both of them are much earlier than those grown at Wageningen in 1933 and 1934, but Heemskerkerduin is hardly in advance of those of Wageningen on Febr. 1st '35. In all probability the influence of climate, position and soil will have caused the difference in 1936 in the date of flower-formation of irises from 2 growing-places. It is further of importance to know that the flower-formation of Iris Imperator sometimes does not start before March 1st but also may be in progress already on Febr. 1st, so that the first formation then has begun in January. The flower-formation tolerates a repeated fall of temperature below freezing-point. Consequently a flower-formation once started is again and again retarded. In the case of Imperator, however, this does not do any harm to the flower.

Geology. — *The occurrence of isolated calicular plates of Dinocrinus in the Permocarboniferous of Australia and India and its stratigraphical significance.* By H. GERTH. (Communicated by Prof. H. A. BROUWER.)

(Communicated at the meeting of June 27, 1936).

By the investigation of the sponges from the Permian of Timor (7) my attention was drawn to fossils described by ETHERIDGE (5) from the Upper Carboniferous of Western Australia as Calceolispongia Hindei nov. gen. nov. spec. ETHERIDGE's figures reminded me of certain very peculiarly formed calicular plates of Crinoids, described by WANNER from the Permian of Timor. A more accurate comparison of the reproductions of Calceolispongia (fig. 1) with those of the basal plates of Dinocrinus cornutus of WANNER (figs. 2, 3) and especially the study of ETHERIDGE's description made this supposition to certainty. The figures of ETHERIDGE clearly show that Calceolispongia is provided with facets at the outer edge of the "cloaca", the shallow paragaster of the supposed sponge. Such facets, however, would be perfectly superfluous at the upper edge of a sponge, and indeed it concerns here the facets by which the polygonal

Fig. 1. Three specimens of Calceolispongia Hindei ETHERIDGE fil. in different positions, according to ETHERIDGE (5) pl. IV, figs. 1—8.

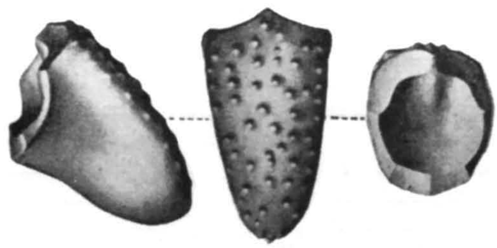

Fig. 2. Dinocrinus cornutus WANN. Basal plate of the calyx in three different positions. After WANNER (14) 1916, Pl. XCVII, fig. 11 *a*—*c*.

Fig. 3. Dinocrinus cornutus WANN. Three different basal plates according to WANNER (15) 1921, Pl. XV, figs. 6—8.

basal plates of the Crinoid calyx have been connected and the supposed "cloaca" is nothing but the slightly hollowed inside of the calicular plate. The ornamentation with small papillose eminences on the convex side of the rounded horn-shaped objects likewise pleads against the sponge nature. ETHERIDGE has to admit that on his "sponges" he could observe neither pores nor ostia, but the microstructure seemed convincing to him. However, of the two reproductions given of this, the one, probably owing to recrystallization of the specimen, is altogether indistinct, while the other clearly shows a structure of meshes, as is characteristic of skeleton parts of echinoderms; only it is particularly strongly magnified[1]) (5, pl. 7, figs. 5, 6).

[1]) ETHERIDGE unfortunately only states: highly magnified.

Form and ornamentation of the objects, the presence of facets on the outside and the microstructure consequently give the certainty that Calceolispongia Hindei is not a sponge but a calicular plate of the Crinoid genus Dinocrinus WANNER, thus far only known from the Permian of Timor. It is much more difficult to ascertain whether the fragments from Australia belong to the species Dinocrinus cornutus WANN. described from Timor, to which, among the three Dinocrinus species known to day, they show the greatest similarity. It is true that most of the Australian pieces on the one side display the same ornamentation with small eminences as the basal plates of Dinocrinus cornutus WANN. but the form is somewhat different. The former are slightly broader at the end and "there is a slight tendency to become belobed in some examples", whereas the lump on the plates of Dinocrinus cornutus from Timor rather has a rounded tapering form. The basal plates of this species, however, also vary somewhat in form, as is shown by WANNER's reproductions (fig. 2 and fig. 3), some pieces likewise having a broader end. In the Australian fragments also a certain variation in the ornamentation occurs, owing to the fact that in one specimen the eminences are replaced by irregular folds. It can, of course, not be decided with certainty whether the above-mentioned differences between the specimens of Australia and those of Timor fall under the variation-range which may occur in the form and decoration of the calicular plates of the same species, the less so as also of Dinocrinus cornutus WANN. only isolated basal plates of the calyx have been found. But Dinocrinus mammeatus WANN., two calyces of which have been described by WANNER (15, pl. 14, figs. 14, 15), shows that the basal plates, not ornamented in this species but also protruding in lump-shape, already vary in form in one and the same individual. The basal plates of Dinocrinus, described as Calceolispongia from Western Australia, may therefore, if we do not want to unite them with Dinocrinus cornutus WANN. itself, at most be distinguished as a variety of this species. As to the nomenclature, here once more the regrettable case is found that a well chosen and characteristic name of the genus Dinocrinus WANNER 1916 according to the law of priority would have to be replaced by Calceolispongia ETHERIDGE 1914, a name entirely misleading for a Crinoid.

In India also isolated plates of Dinocrinus or of related genus appear to occur, viz. in the "Umaria beds" in Rewah State, Central India. These marine beds are found at the basis of sandstones of the Barakar series, which contains a typical Lower Gondwana flora. Among the fossils from these beds described by COWPER REED (1), I was struck by some which he considered "dermal tubercles of fish" (fig. 4). They are polygonal or, probably by weathering, rounded plates of c. 8 mm diameter, tapering at the upper edge to a horn-shaped, curved protuberance. Here also the surface of these protuberances is ornamented with small grains. The presence of facets on the edge of the better preserved plates, showing a similar arrangement as those on the plates of Dinocrinus, led me to suppose that in this case also we have to deal with isolated calicular plates of Crinoids and not with tubercles of fish. Perfect certainty, however, will

Fig. 4. Three different specimens of "dermal tubercle of fish". After Cowper Reed (1) Pl. 35, figs. 14—16 and 18.

only be obtained by the investigation of the microstructure of one of the fragments from the Umaria beds. With the species of Dinocrinus described from Timor these cannot be united; in Dinocrinus aculeatus WANN. of Timor the basal plates indeed also possess pointed protuberances but these are straight and not curved in horn-shape. In any case, however, we have to deal here with a new species of Dinocrinus or with a closely related genus.

I am inclined to think that the occurrence of the calicular plates of Dinocrinus has a certain stratigraphical significance, particularly where the occurrence in Western Australia is concerned. As we have seen, we have to do here with a form which in all probability is identical with Dinocrinus cornutus WANN. from Timor. However, thus far it has always been apparent that such highly specialized forms as the Dinocrinus species with their peculiarly shaped basal plates live for a comparatively short time. If consequently Dinocrinus cornutus WANN. is found on Timor in the Permian, viz. in the Lower Permian Bitauni beds, it seems fairly certain that also the beds in Western Australia in which it occurs are Permian and not Carboniferous, as was still recently stated by the Australian geologists. That Dinocrinus cornutus WANN. is indeed a species of relatively limited lifetime is also apparent from the fact that on Timor it occurs only in the Lower Permian Bitauni beds. Lately an enormously large material of fossils from the Middle Permian Basleo beds was sifted in the Geological Institute of Amsterdam, but among the many thousands of Crinoids from these beds not a single basal plate of Dinocrinus cornutus was found.

The occurrence of Dinocrinus cornutus WANN. consequently pleads in favour of the Lower Permian age of the late Palaeozoic marine beds in Western Australia. This age was, moreover, recently also proved by the results of other investigations. A. K. MILLER (9) made an elaborate study of Paralegoceras jacksoni (ETHER.), the only Cephalopod in these beds, and was able to point out that this goniatite differs from Carboniferous Paralegoceras species and has to be classified with the Permian genus Metalegoceras. Particularly in the characteristic umbilical region its sutural line displays a pronounced similarity to Metalegoceras somoholense (HANIEL.) from the Lower Permian of Timor, which very likely is merely a juvenile specimen of Metalegoceras evolutum HAN. Further

K. L. PRENDERGAST (10) has recently revised the determination of various Brachiopoda from the above-mentioned beds and has shown that only a few species are not known from the Permian but that most of them have their main extension in this formation. It can, therefore, no longer be doubted that the beds in which these fossils occur are of Lower Permian and not of Upper Carboniferous age, as was stated by DAVID and SÜSSMILCH (2).

The determination of the age of these beds is of great importance because they follow in normal succession above the glacial deposits and in this way we can also obtain a determination of the age of the Upper Palaeozoic glaciation. Western Australia is the only part of the Gondwana region where the marine beds connected with the glacial deposits have yielded a Cephalopod, the above-mentioned Metalegoceras jacksoni ETHER., which admits a determination of the age and further parallelization of these beds. As we have seen, this goniatite is closely related to a species from the Bitauni beds of Timor which, according to WANNER (16), by means of their cephalopod fauna may be parallelized with the Upper Artinskian beds, the lower part of the Sosio limestone and the Leonard formation in Texas. It is true, also in other regions above the glacial deposits marine beds are found, but thus far these have only yielded indifferent faunas, in which the Brachiopoda prevail, and a decisive determination of their age is not possible. They are particularly frequent in S. E. Australia in New South Wales (Lower marine series). Indeed in these beds also the occurrence of a goniatite, Agathiceras micromphalum, was recorded, but according to later researches (13 p. 5) this appeared to be a Bellerophon. Similarly about the age of the Lower Productus-limestone in the Salt Range and the Bareal beds in Argentina the opinions of the investigators even recently differed greatly. DUNBAR (4), however, who subjected the Fusulinae of the former formation to a revision, came to the conclusion that these rather show a Permian than a Carboniferous character, and indeed the Lower Productus-limestone is now placed in the Permian by FOX (6) of the Geological Survey of India. Nevertheless, all investigators agree that these beds, which all show the same connection with the underlying glacial deposits, must approximately be of the same age. The Eurydesma conularia fauna occurring on a slightly lower level in some regions is left out of consideration here, since it is equally useless for a parallelization of the age. However, if now the Permian age of the marine beds in Western Australia is proved, it is evident that also the other above-mentioned marine beds, showing a similar connection with the glacial deposits, likewise must be of Permian age. Indeed a Lower Permian age has lately been suggested by DAVID and SÜSSMILCH (3), while a Middle Permian age, as pleaded by SCHUCHERT (11, 12) cannot be taken into consideration because the genus Metalegoceras is no longer present in the Middle Permian Basleo beds. If, however, as we have seen, the marine beds are of Lower Permian age, I do not see an objection to place the underlying glacial deposits at the basis of the Permian. The geologists (8) who have always spoken of a Permian ice-age will thus be proved to be in the right. The supposed glacial horizons in the Carboniferous Kuttung series in S. E. Australia are left out of consideration here.

SUMMARY.

The fossils described by ETHERIDGE from the late Palaeozoic beds of Western Australia as Calceolispongia Hindei ETHER. are no sponges but isolated calicular plates of a Crinoid, belonging to the genus Dinocrinus from the Permian of Timor, very likely even to the species Dinocrinus cornutus WANNER from the Lower Permian Bitauni beds of this island. Likewise the fossils from the late Palaeozoic Umaria beds in India, supposed to be tubercles of a fish, evidently are skeleton plates of Dinocrinus or a genus related to this. The occurrence of Dinocrinus cornutus WANN. in Western Australia is considered a new proof of the Lower Permian age of the marine beds which, owing to their connection with the underlying glacial deposits, also admit a conclusion concerning the age of the late Palaeozoic ice-age.

LITERATURE.

1. COWPER REED, F. R. A Permo Carboniferous marine Fauna from the Umaria Coalfield. Rec. Geol. Surv. of India **60** (1928).
2. DAVID, T. W. E. and SÜSSMILCH, C. A. Upper palaeozoic glaciations of Australia. Bull. Geolog. Soc. of America **42** (1931).
3. DAVID, T. W. E. and SÜSSMILCH, C. A. The carboniferous and permian periods in Australia. XVI Int. Geolog. Congr. Washington (1933).
4. DUNBAR, C. O. Stratigraphic significance of the fusulinids of the lower Productus limestone of the Salt Range. Rec. Geolog. Surv. of India **66** (1933).
5. ETHERIDGE, R. Jr. Palaeontological contributions to the geology of Western Australia. Geolog. Surv. West. Australia **58** (1914).
6. FOX, C. S. The Gondwana System and related formations. Mem. Geolog. Surv. of India **58** (1931).
7. GERTH, H. Die Spongien aus dem Perm von Timor, Palaeontologie v. Timor **16** (1929). Jaarb. v. h. Mijnwezen in Nederl. Indië **55** (1927).
8. GERTH, H. Die Korallenfauna des Perm von Timor und die permische Vereisung. Leidsche Geolog. Mededeel. **2** (1926).
9. MILLER, A. K. Metalegoceras jacksoni of the Irwin River coalfield, Western Australia. Amer. Journ. of Scie. **24** (1932).
10. PRENDEGAST, K. L. Some Western Australian upper palaeozoic fossils. Journ. Roy. Soc. West. Australia **21** (1935).
11. SCHUCHERT, CH. Review of late palaeozoic formations and faunas, with special references to the ice-age of middle permiam time. Bull. Geolog. Soc. Amer. **39** (1928).
12. SCHUCHERT, CH. The Australian late palaeozoic glaciations. Amer. Journ. Scie. **23** (1932).
13. THOMAS, H. D. The late palaeozoic glaciation. Nature (1929).
14. WANNER, J. Die permischen Echinodermen von Timor, I Teil. Palaeontologie v. Timor **6** (1916).
15. WANNER, J. Die permischen Crinoiden von Timor. Jaarb. v. h. Mijnwezen in Nederl. Indië, Verh. 3 (1921).
16. WANNER, J. Das Alter der permischen Basleo Schichten von Timor. Zentralbl. f. Min. etc. B (1931).