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PERMIAN TRILOBITES FROM TIMOR AND SICILY

WITH A REVISION OF THEIR NOMENCLATURE AND CLASSIFICATION

BY

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ROGER FREDERIC CHARLES ROSALIE GHEYSELINCK

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AMSTERDAM
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Gratefully presented to my Parents.
Affectionately dedicated to Miss Hilda Mijnlieff.

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SAMENVATTING.

I. Het uitsterven eener bepaalde diergroep wordt gewoonlijk voorafgegaan door een snelle en intensieve degeneratie, waardoor de laatste geslachten gesplitst worden in een zeer groot aantal soorten, welke dan nog slechts door weinige individuen vertegenwoordigd zijn. Daarbij is de verscheidenheid der onderling verschillende vormen vaak zoo groot, dat de werkelijke affiniteiten minder opvallend zijn dan de inderdaad soms vrij belangrijke morphologische verschillen. Voor den systematicus bestaat dan het gevaar, dat hij secundaire eigenschappen a priori als geslachtskenmerken gaat beschouwen en dan langzamerhand gedwongen wordt tot het opstellen van een zeer groot aantal monotype genera.

Voor de uitstervende trilobieten van het Boven-Carboon en van het Onder- en Midden-Perm heeft dit geleid tot een nomenclatuur en classificatie, waarin elk gevonden specimen gemakkelijk tot een nieuw genotype kan verklaard worden. Het is duidelijk, dat voor de familie der *Proetidae*, het genus-begrip veel grooter van omvang en kleiner van inhoud moet zijn dan voor de minder bouwvallige trilobieten-families uit vroegere geologische perioden. Een nieuw genus mag hier eerst opgesteld worden, wanneer de diagnose werkelijk kan steunen op een zoo groot mogelijk aantal onafhankelijke en constante kenmerken. Dat de perm-genera dan een zeer heterogeen karakter zouden dragen, kan moeilijk als een bezwaar aangemerkt worden, wijl deze heterogeniteit juist inhaerent is aan de intensieve degeneratie van het uitstervend geslacht en in de systematieke indeeling overigens uitgedrukt kan worden door een rangschikking in groepen, waarin de verwante species kunnen samengebracht worden tot het voldoende gebleken is, dat de verheffing van een dergelijke groep tot genus werkelijk verantwoord is en steunen kan op kenmer-

ken, die een grootere constantheid en onafhankelijkheid blijken te bezitten.

De kritiek der bestaande nomenclatuur leert, dat de diagnosen van PORTLOCK's genera *Phillipsia* en *Griffithides* (1843), door een kleine wijziging in hunne formuleering kunnen aangepast worden aan moderne normen en dan van een zoodanigen inhoud en omvang blijken te zijn, dat ze met *Brachymetopus* MCCOY en *Proetus* STEININGER, alle tot nog toe beschrevene perm-trilobieten kunnen omvatten, zonder dat men genoodzaakt zij, zijn toevlucht te nemen tot nieuwe en op onzekere kenmerken gegrondveste genera. De wijzigingen, welke daartoe in PORTLOCK's formuleeringen dienen aangebracht te worden, zijn af te leiden uit de beschrijvingen van PORTLOCK zelf en schijnen voor het overige ook beter in overeenstemming te zijn met PORTLOCK's bedoelingen dan de emendaties, welke men later aan de diagnosen zijner genera aangebracht heeft.

Geen der jongste onderzoekingen (TESCH 1923, WEBER 1933, TOUMANSKY 1935 en WELLER 1936) heeft essentiëele wijzigingen kunnen brengen in de classificatie van PORTLOCK, en de genera, welke men na hem in steeds toenemend aantal opgesteld heeft, steunen meerendeels op een klaarblijkelijk foutieve interpretatie van PORTLOCK's inzichten. Alleen in de zoogenaamde "verkorte glabella", door WEBER (1933) in zijn subgenus *Cyphinium* (later met *Ditomopyge* NEWELL geïdentificeerd) duidelijker omschreven, schijnt een nieuw en betrouwbaar kenmerk gevonden te zijn, waarop men thans een meer gedetailleerde onderverdeeling in subgenera kan steunen.

In het licht dezer conclusie moet een groot aantal der in de laatste decennia opgestelde geslachten, als ongefundeerd of niet voldoende onafhankelijk, vervallen, en de herziene nomenclatuur der perm-trilobieten kan dan als volgt samengevat worden:

1. Genus *Brachymetopus* MCCOY.

   De subgenera *Brachymetopus* s.s. en *Brachymetopina* REED kunnen niet als zoodanig in stand gehouden worden. Het met *Brachymetopus* MACCOY geïdentificeerde genus *Cheiropyge* DIENER is te onvoldoende bekend, opdat deze identificatie kunne bevestigd worden.

2. Genus *Proetus* STEININGER.

   Subgenus *Permoproetus* TOUMANSKY.

3. Genus *Phillipsia* PORTLOCK.
   a. Subgenus *Phillipsia* s. s.
      Hiertoe moeten gerekend worden de genera *Ameura* WELLER, *Neogriffithides* TOUMANSKY en *Paraphillipsia* TOUMANSKY.
   b. Subgenus *Neophillipsia* n o v. s u b g.
      Een gedeelte van WELLER's genus *Sevillia* moet hier ondergebracht worden.
4. Genus *Griffithides* PORTLOCK.
   a. Subgenus *Griffithides* s. s.
      Tot dit subgenus behooren de genera *Neoproetus* TESCH, *Exochops* WELLER, *Paladin* WELLER en *Kaskia* WELLER
   b. Subgenus *Pseudophillipsia* GEMMELLARO.
      Hiertoe behooren *Anisopyge* GIRTY en *Ditomopyge* NEWELL (= *Cyphinium* WEBER) en voor het grootste deel ook het genus *Sevillia* WELLER (o.a. het genotype *Sevillia sevillensis* J. M. WELL.).

De subgenera *Permoproetus*, *Neophillipsia* en *Pseudophillipsia* zijn phyllogenetisch resp. af te leiden van *Proetus*, *Phillipsia* en *Griffithides*, waaruit zij telkens door een evenwijdige, en duidelijk p r o g r e s s i e v e, evolutie ontstaan zijn. Deze laatste schijnt vooral gekenmerkt door een toenemen van het aantal segmenten in het pygidium en een daarmede gepaard gaande verkorting van de glabella. De evenwijdigheid dezer ontwikkelingslijnen is alleen in zoover onvolkomen, dat de nek-lobben (cervical lobes) in *Permoproetus* op den nekring liggen (de mediaan lobus is daar o c c i p i t a a l), terwijl in *Neophillipsia* en *Pseudophillipsia*, deze lobben in de nek-groeve liggen en daar dus geven: 1 mediane p r e-o c c i p i t a a l - lobus en 2 postero-lateraallobben.

II. Van de timoresische Besleo-lagen worden beschreven *Phillipsia hildae* n. sp., *Griffithides indicus* TESCH, *Griffithides baungensis* n. sp., *Griffithides trigonoceps* n. sp., *Griffithides gerthi* n. sp., *Griffithides breviceps* n. sp., *Griffithides breviceps* n. sp. *var. axistriata* nov. var., *Griffithides brevicauda* n. sp., *Griffithides teschi* n. sp. en *Griffithides* (*Pseudophillipsia*) *timorensis* n. sp.

Deze fauna wordt in haar geheel gekenmerkt door 1) een duidelijke vermenging van een conservatief, ouder element met een sterk gespecialiseerde en gedifferentieerde groep van jongere

trilobieten en 2) door het duidelijk overheerschen van *Griffithides indicus* TESCH, dat als een betrouwbaar gidsfossiel voor de permische Besleo-lagen kan beschouwd worden en als zoodanig ook een groote gelijkenis vertoont met de onder de trilobieten van de siciliaansche Fusulinen-kalksteen domineerende *Griffithides verrucosus* GEMM.

Van de Sosio-vallei bij Palermo in Sicilie worden beschreven *Griffithides verrucosus* GEMM, *Phillipsia sicula* GEMM en *Griffithides (?) juvenalis* n. sp., vormen, die evenals de vroeger door GEMMELLARO (1892) beschrevene, opvallen door hunne zeer geringe afmetingen. Daar ook de andere diergroepen van de Sosio-fauna gewoonlijk door kleine individuen vertegenwoordigd zijn, kunnen we deze fauna beschouwen als een "miniatuur- of dwergfauna" zonder dat we voor het oogenblik in staat zijn een plausibele verklaring voor dit regionaal, tot Sicilie beperkte, verschijnsel te geven.

I. INTRODUCTION

In his beautiful contribution to GURICH's "Leitfossilien" HERMANN SCHMIDT (1929 p. 77) ascertained that even scanty findings of trilobites might be sufficient to date with security a carboniferous marine horizon; but in reference to the considerable confusion actually existing in the classification of the carboniferous trilobites, he thought it absolutely necessary, that a thoroughly revision should be undertaken of their nomenclature before they ever could be used as reliable zone fossils for the late palaeozoic strata.

Although it can be doubted, for several reasons, that the trilobites will once afford valuable index fossils for such transitional zones, generally denoted, by way of precaution, as the permo-carboniferous beds, or for the even more problematical permian stratigraphy, the revision of the permian genera remains as imperative as that of the true carboniferous forms, since the complete understanding of the latter will appear to be wholly impossible, without the palaeontological and morphological intelligence afforded by the former. Such a revision, though it can in no way be given completely for the moment, is the more wanted as the nomenclature of the permo-carboniferous trilobites is actually founded upon a chaotic compilation of erroneous descriptions, general statements and premature conclusions, so that by every new description the confusion is growing greater.

WOODWARD (1883) already tried to find out the causes of this complete disorder, and as such he mentioned:

1°. the too often fragmentary condition of the specimens obtained;
2°. the unsatisfactory figures, which accompany the descriptions of most of the earlier writers on permo-carboniferous trilobites;
3°. the very near affinities actually existing between the genera *Phillipsia* and *Griffithides*;

The first and second of those reasons need no explanation. They are not peculiar to the permian trilobites and present an impregnable mischief throughout the whole palaeontological literature. In a more

generalized formulation the third will be discussed afterwards. Yet there are three other causes of confusion to be set forth here as more particular to the permo-carboniferous trilobites:

1°. the vague notions and ambiguous presentive words, used by several authors in their definitions and descriptions. The genus *Neoproetus*, among others, will afford evident proof of the erroneous conclusions, to which TESCH, GRABAU and others were led by a misleading inaccuracy of PORTLOCK in the discrimination of his new genera *Phillipsia* and *Griffithides*;

2°. the unproved and often contradictory general statements, again and again repeated every time as permian trilobites were concerned. In most of the palaeontological textbooks or in other summarizing works on trilobites, it is for instance, generally stated that the genus *Proetus* STEININGER is stratigraphically confined to the carboniferous and earlier systems, it, as generally presuposed, having been replaced in the Permian by the last survivor of the trilobites *Phillipsia* PORTLOCK, whose most striking systematical difference should moreover consist in a somewhat larger pygidium. It can not be doubted and a good deal of descriptions prove it, that such a statement was most suitable gradually to settle the double conviction that:

α. a permian trilobite had necessarily to belong to *Phillipsia*, or, when the differences with the latter were too evident, had consequently to be considered as the genotype of a new genus or subgenus;

β. the dimensions of the pygidium and especially the number of segments in its axial lobe had necessarily to be treated as the most typical feature of generic importance. In fact a great many of specimens, especially the lose pygidia, discovered in permo-carboniferous beds have been pressed into the genus *Phillipsia* for the single reason they had a number of axial segments larger than that diagnostically required for the genus *Proetus*, and where this artificial contradistinction was afterwards also inaugurated in the discrimination of new genera it contributed very much in the systematical confusion of the permo-carboniferous trilobites;

3°. the extreme diversity of strongly spe-

cialized forms, by which an animal group presents itself on becoming extinct;

This breaking up of an united group into an infinite number of but slightly different forms, on the eve of its extinction, has apparently been too much underrated in the palaeontological literature, though it was sufficiently demonstrated by the youngest ammonites and again, in more recent publications on permian formations, by the last trilobites. Attention was drawn upon it, at first I mean by GERTH (1930 p. 14), who seems to encline to the assumption that the arising of a great number of strongly specialized species, each represented by only few individuals is obviously the cause of the starving out of the whole group.

There is certainly a most fascinating analogy to be noted between this splitting of a genus at the upper limits of its stratigraphical distribution and the extreme diveristy of different varieties at the boundaries of the geographical realm of widely distributed, living species (HESSE 1824 p. 134). Distant "in time" from the moment of its highest development an animal group breaks up, just as it nowadays does "in space", when removed from the centre of its geographical distribution. In both cases it seems to fail the conditions required for a progressive evolution and to "degenerate" — rapidly and intensively — into a multitude of strongly specialized, aberrant forms.

Though from the actualistic point of view, the recent, zoogeographical phenomenon might theoretically have been responsible for the diversity and differentiation actually existing in some palaeontological animal groups — thus giving opportunity to doubt of the stratigraphical phenomenon — it can by no means explain satisfactorily the extreme specialisation and differentiation of the permocarboniferous trilobites, whose morphological diversity is so general, that it appears to be wholly independent of any local distribution. In all regions, where younger permo-carboniferous trilobites have hitherto been discovered, the related diversity is so evident and strong, that each specimen obtained could easily be considered as representative of a new genus.

In the case of the permo-carboniferous trilobites, the sug-

gested diversity does however not consist in a great multitude of forms, differing entirely among them, but rather in the fact, that these forms differ in one or two, more or less well-defined features, while at the same time, they have some morphological characters in common with one group, viz. genus and several others identical with those of another genus. So for instance, the cephalic shields of two or more permian trilobites may be absolutely identical, while the pygidia of the same individuals may be so entirely different that they, to all appearance, hardly can be brought to related genera.

The cephalon of *Neoproetus* TESCH is the typical one of *Griffithides* PORTLOCK, but in its proetid pygidium it exhibits such aberrant peculiarities that TESCH (1923) considered it as the genotype of a new subgenus of *Proetus*, notwithstanding the fact, that the diagnosis of *Proetus* STEININGER excluded all pyriform, forwardly expanding glabellae. With less prudence one could have found, as we will see, in the configuration of the marginal border of the pygidium of the holotype of *Neoproetus indicus* TESCH enough indications to found a new genus or even to doubt of its belonging to the family of the *Proetidae*. This doubt however is again prevented by the discovery of a specimen, afterwards to be described, exhibiting all the morphological characters of *Neoproetus indicus* TESCH, with but one exception: its regularly shaped marginal border of the pygidium!

Paraphillipsia TOUMANSKY, has a pygidium typical for *Proetus*, but in its cephalon it unites features both of *Phillipsia* and *Griffithides*.

These striking affinities interfering with remarkable and systematically insusceptible differences, though they seem quite comprehensible in the light of a specialisation and differentiation of a dying fauna, are now mainly responsible for the considerable confusion in the nomenclature of the permo-carboniferous trilobites, since from our imperfect knowledge of those trilobites — SCHMIDT stated that *Neoproetus* TESCH was the best known genus! — it is moreover extremely difficult to discriminate precisely the features of generic importance from those, which are specific or individual. Some of the most instructive and conclusive instances of confusion

may be put forward here in order to illustrate in what way the classification of the permo carboniferous trilobites was, at different times, influenced by their rapid and intense differentiation.

α. The striking affinities on the one side and the obvious morphological differences on the other, occasionally caused the bringing together of entirely different forms into one species viz. genus, or the discrimination of closely related specimens into wholly different species or genera. In this connection the moved history of *Phillipsia sicula* GEMM. is most instructive. Brought by its author to *Phillipsia* in spite of the small number of axial segments in its pygidium and the distinctly pear-shaped outline of its glabella, it was reckoned by TESCH (1923) to *Griffithides* in spite of the presence of short lateral furrows in its glabella and notwithstanding the fact TESCH considered elsewhere 9 pygidial segments as wholly incongruent with the diagnosis of *Griffithides* PORTLOCK. In the foundation of his genus *Neogriffithides*, TOUMANSKY (1935) claimed the systematical importance of the glabellar furrows, but in bringing *Griffithides sicula* GEMM. to *Neogriffithides* he apparently considered as of no significance the difference between 9 axial segments in the pygidium of *Neogriffithides sicula* GEMM and from 17 to 20 as diagnostically required for his new genus *Neogriffithides*.

β. In those repeated transfers and manipulations or in new descriptions it happened very often that the diagnosis of the genus, to which a species was thus brought was not sufficiently enlarged by emendations to include effectively the species concerned. *Neogriffithides sicula* GEMM already afforded an instance of this systematical inaccuracy. In 1914 KING described *Griffithides shunnerensis* from the carboniferous Mill-stone grit of Yorkshire, with 16 axial segments in its pygidium; but all descriptions and contradistinctions of TOUMANSKY (1935) for instance, were still founded upon a diagnosis, wherein only from 10 to 13 segments are adjudged to *Griffithides*. VODGES (1887) and WEBER (1933) textually state the generic status of *Griffithides* PORTL. as having from 10 to 13 axial segments in the pygidium, but a t t h e s a m e t i m e, they describe several species as *Griffithides*, with an entirely different number of pygidial segments compare for instance, among other species:

in VODGES, *Griffithides sangamonensis*: 17—18 axial ribs
in WEBER, *Griffithides rotundus*: 16 segments
Griffithides praepermicus: 17—20 segments

Neoproetus, once considered as a subgenus of *Proetus* required an emendated diagnosis of the latter including also species with pyriform glabella.

γ. Inversely when from a definite genus a group of species was separated under a new generic name there was not always taken care for a corresponding narrowing of the old diagnosis.

By the foundation of *Griffithides* as an independent genus, including the species with pear-shaped glabella, PORTLOCK (1843) evidently excluded at the same time that pyriform condition from the diagnosis of *Phillipsia*. How could then *Pseudophillipsia* GEMMELLARO be maintained all the time as a subgenus of *Phillipsia* PORTLOCK? GEMMELLARO was perhaps entitled to do so, since he, without any justification, also reduced *Griffithides* to the rank of a subgenus of *Phillipsia*. This implied de facto a considerable emendation of the diagnosis of *Phillipsia* and there certainly was no reason to follow GEMMELLARO in his obvious misinterpretation of PORTLOCK's intentions, the more as *Griffithides* was afterwards rightly considered again as a separate genus.

δ. As a matter of fact misleading reasonings have been founded upon that misinterpretation and in general upon the successive elevations of a subgenus to the rank of a genus or upon the inverse reductions. A warning instance can be found in TESCH's discussion of *Phillipsia sicula* GEMM. and *Griffithides verrucosus* GEMM, whose pygidia, on account of their 9 axial segments, could not belong, in TESCH's opinion, to *Phillipsia* and "therefore" neither to *Griffithides* (TESCH 1923 p. 128).

Upon that argumentation was indirectly founded the creation of the subgenus (afterwards genus!) *Neoproetus* TESCH, to which was also brought *Griffithides verrucosus* GEMM. When *Griffithides* had been considered as an independent genus, as it ought to be and as it was previously done by PORTLOCK (1843), WOODWARD (1883), VODGES (1887) and afterwards also by WEBER (1933) and TOUMANSKY (1935), TESCH's "therefore" would have been eliminated and there would have been no difficulty to bring both representatives of *Neoproetus* to *Griffithides*, since

the pygidium of the latter may exhibit 10 axial segments and it now moreover can be stated that *Neoproetus indicus* TESCH, as well as *Neoproetus verrucosus* GEMM. have effectively 9 or 10 coalesced segments in their pygidial axis.

The result was necessarily a striking ambiguity in the diagnoses of several permo-carboniferous genera, so that nowadays the determination of a permian trilobite is much complicated by the existence side by side, of several diagnoses, for one and the same genus, differing to an high degree among them.

Different solutions have now hitherto been proposed to the multiple systematical difficulties gradually arisen in the classification and nomenclature of the permo-carboniferous trilobites and but partly illustrated in the few instances recorded above.

1°. In connection with *Neoproetus* TESCH, whom he, without nearer justifications brought to *Griffithides* PORTL., WEBER (1933 p. 70) expressed the opinion that as concerns the classification of the carboniferous *Proetidae*, difficulties in generic determinations will so long be met with till a triple nomenclature is established, consisting of the generic name of the concerned form, based on the latter's cephalon followed by its generic name based on the pygidium and lastly of the specific denomination; according to such a nomenclature TESCH's timorese form should be termed *Griffithides-Proetus indicus*.

It is however clear that such a triple nomenclature, thus conceived, will never bring the solution imperatively wanted here, mainly because:

α. it would require that the forms, whose generic names were to be applied, should a p r i o r i be considered as extremities of an evolutive series.

β. it would a p r i o r i establish the general configuration of the cephalon and the pygidium as the most important — if not as the only — systematical features of generic importance.

γ. if notwithstanding secondary resemblances were to be reckoned with in the generic denominations this triple nomenclature would rather complicate the classification of the permo-carboniferous trilobites. How would for instance *Neogriffithides sicula* GEMM. be termed in such a nomenclature? In its cephalon it unites features both of *Phillipsia*

and *Griffithides*; in its pygidium it is a typical proetid. Let us admit one moment that the *Griffithides*-character dominates in the cephalon. The name would then be *Griffithides-Proetus sicula*, just the same as that of the entirely different *Neoproetus*, without any indication of its evident resemblances to *Phillipsia* PORTLOCK. A form morphologically situated between *Neogriffithides* and *Neoproetus* would have the same generic name in which nothing should be said about the near affinities to *Neogriffthides* or to *Neoproetus*. If notwithstanding such affinities were to be reckoned with, then a triple nomenclature would not be sufficient and *Neogriffithides sicula* GEMM. would become, at least, *Griffithides-Phillipsia-Proetus sicula* GEMM.

2°. Part of the systematical difficulties were boldly slighted by TOUMANSKY (1935) who elevated all the existing subgenera to a generic rank and founded several new genera, without restricting the diagnoses of the previously established ones, so that the notion of the subgenus has practically disappeared from the nomenclature of the permo-carboniferous trilobites.

This was however wholly premature and gave already in TOUMANSKY's conclusions themselves occasion to contradictory statements. The main objections I have to bring up against TOUMANSKY's classification are:

α. the lack of any equivalence between his different genera. In such a classification the generic contradistinctions between *Neoproetus* TESCH and *Griffithides* PORTLOCK must have the same significance and importance than those between *Proetus* and *Phillipsia*. The differences between two species of *Griffithides* are, for instance, often more evident than those between the two genera *Neoproetus* TESCH and *Permoproetus* TOUMANSKY.

β. the broad marge of overlapping of the diagnoses of two or more genera. This is the more inaccurate as the generic diagnoses are often arbitrarly established. *Neogriffithides* TOUMANSKY, which should have from 17 to 20 segments in its pygidial axis was, at the same time, supposed to include also *Griffithides sicula* GEMM. with but 9 axial segments.

γ. the small number (often one or two) and the mean constancy of the features upon which a new genus is established.

δ. the doubtful systematical importance of some of the morphological characters upon which most of the generic contradistinctions are based.

ε. These insufficiently founded generic discriminations finally bring about that each genus effectively encloses but few species. A consequent and logical application of TOUMANSKY's principles will gradually eliminate also the notion of the species in the nomenclature of the permo-carboniferous trilobites, since on account of the existing diversity each specimen obtained can easily be made the genotype of a new genus.

3°. WELLER (1936) went even further in this direction and supposed that several distinct groups were present in PORTLOCK's genera. *Phillipsia* and *Griffithides*. He therefore emended the diagnoses of those genera to accomodate two of these groups and distinguished furthermore several new genera. From the 8 genera he thus establishes 3 are emended and 5 are new. Only two of them are illustrated by the description of a new species. It is evident that the objections uttered against TOUMANSKY's classification must subsist here in an even higher degree. Besides I can not agree with WELLER in the arbitrarly restricting and emendating of the diagnoses of previously established permo-carboniferous trilobite-genera, mainly because:

α. such restrictions and re-arrangements must be founded upon a critical examination of all previously described species belonging to the re-arranged group and can therefore not be undertaken, especially in the case of the permo-carboniferous trilobites, upon the base of specimens discovered in a single region, in casu the North-American carboniferous beds.

β. a r e s t r i c t i o n of an existing diagnosis must be accompanied by the foundation of at least one new genus in order to accomodate the species of the old genus, excluded by the restriction. In fact several species previously described as *Phillipsia* or *Griffithides* appear to be entirely different from WELLER's new genera and as they no longer fit in the emended old ones we should be compelled to create several new genera, especially for them. Such new genera could then only be founded upon earlier descriptions and upon often

very unsatisfactory figures. These difficulties were already felt by WELLER himself, as he ,at different times, indicates that a species should probably be removed and made the type of a new genus. Such species as *Phillipsia derbiensis* MARTIN and *Griffithides globiceps* PHILLIPS have on the moment no generic status and can be made, on the very first opportunity, types of uncertain new genera.

γ. The emendations of *Phillipsia* and *Griffithides* PORTLOCK, as formulated by WELLER, place several new genera, narrowly limited, next to such ones as *Proetus* STEININGER and *Pseudophillipsia* GEMMELLARO, whose diagnostical range is much larger and therefore wholly disproportioned to the emended genera of WELLER.

δ. It can not be doubted that in such a classification, the least morphological differences must have a generic importance and that under the existing diversity among the permo-carboniferous trilobites the number of genera will be, even more than in TOUMANSKY's classification, increasing continually, each being represented by only one or two species. This must on the other side lead to unreliable conclusions. TOUMANSKY, for instance, in not finding "g e n e r i c" resemblances between the trilobite-faunas of Timor and Crimea concluded that there were no closely allied forms in both these regions, despite of their doubtless similar age; while he found extremely great resemblances with the permo-carboniferous trilobites from the sicilean Fusulina-linestone. This seems however very contradictory, since the faunae of Sicily and Besleo (even including the trilobites) are almost identical. A comparison among *Griffithides indicus* TESCH and *Griffithides verrucosus* GEMM. is very conclusive in this connection.

It is clear that with regard to the related diversity among the permo-carboniferous trilobites an i d e n t i f i c a t i o n of two faunas or even of two genera from distant regions is almost impossible. Comparisons must rather be founded upon resembling combinations of well-defined morphological characters, exhibited by the fauna of each region as a whole. Such comparisons are now much complicated by the existence of numerous, insufficiently established and narrowly limited genera.

If we thus accept the classifications of TOUMANSKY and WELLER, we will finally be compelled to consider the slight differences, obviously caused by the strong differentiation of this dying fauna, as of generic importance and we will consequently be compelled to create new genera upon a morphological feature of seemingly secondary importance, notwithstanding the fact of the evidently striking affinities between the specimens hitherto discovered. Most of these affinities, as well as GERTH's formulation, mentioned above, doubtessly point to "specific" differences and surely press for prudence in the discrimination of new genera, whose diagnostical extent should not be limited as narrowly than those in the better known and less decayed trilobite-genera of earlier systems. It should at last be remembered here, that a "genus" is a miscellany of species, differing among them. In the classifications, hitherto established, it has almost lost its true significance.

4°. I therefore might propose another solution to the existing systematical confusion and adopt here the group-arrangement, as inaugurated by RICHTER (1926) for several devonian genera. The advantages of such an arrangement, at least for the permo-carboniferous trilobites, are evident.

a. the diagnoses of once established genera have not to be arbitrarly emended or restricted every time a new discovered and but slightly aberrant form has to be systematically ranged;

b. By bringing together, where possible, different closely related species, we will not only considerably reduce the number of uncertain genera, but constitute, at the same time, several groups, whose discriminating features will finally represent a combination of several (the more, the better!) independent, morphological characters. Such combinations will easily be used by following investigators for the foundation of new, and this time, less uncertain genera. Systematically speaking each of those groups might be considered as a subgenus and consequently receive an appropriated name; but in doing so, we would miss the pro-

posed aim and rather complicate the existing confusion, since each of these subgenera would necessitate, just as imperatively as the genus, a definite and more narrowly limited diagnosis. This must however be prevented and the group can, when necessary and where clearly constituted, be denominated according to the specific name of the most representative species, or according to the evident and typically discriminating character of the group.

c. In the proposed arrangement every new described specimen can easely be rapproached to a closely related species. Thus *Neoproetus indicus* TESCH might have been rapproached to *Griffithides verrucosus* GEMM. to constitute with the latter a so-called verrucosus-group. In doing so TESCH would have avoided the creation of the genus *Neoproetus*, whose representatives doubtessly belong to the same genus as all true *Griffithidae* hitherto described;

d. If on the contrary such a rapproachment to a closely related species should be wholly impossible, it will not be necessary to create a separate genus for a single specimen, since such a specimen may fit into a genus, without belonging to a definite group. This possibility will present considerable systematical advantages in such cases, where species have been erroneously described and — as in the foregoing classifications — ought to be transferred in another genus. In the group-arrangement it will in such cases generally be possible to maintain the generic name of the species concerned. So for instance, it will be clearly shown that the specimen described by GRABAU (1936) as *Neoproetus sinensis* can never be considered as a representative of *Neoproetus* TESCH. In the existing "generic" classifications this crushed specimen, incorrectly and inaccurately described by its author, should have to be made the genotype of a new genus. In the proposed, more "specific" group-arrangement it remains a true *Griffithides*;

e. If it is true that for generic determinations in this kind of classification, more value is laid upon the resemblances and affinities than upon the differences, at least there is no opportunity to run the risk that one or two secondary characters should be judged sufficient to diagnose a genus. In

the proposed arrangement we will afford the possibility gradually to assemble the more constant features, upon which a genus can ulteriorly be founded with greater security. As a matter of fact the group-arrangement, especially for the permian trilobites, will better agree with the related assumption that the differentiation of a dying fauna is rather expressed in specific differences. The morphological differences between two distant species will moreover be sufficiently demonstrated in the different groups, they are brought to.

f. Evolutionary t e n d e n c i e s have been discovered in the permo-carboniferous trilobites by several authors (WEBER 1933 and WELLER 1937); but the evolution, specialisation and differentiation is by far more complicated than could be deducted from the tendencies hitherto discovered. I therefore firmly believe that the proposed group-arrangement will be more appropriated to express the complicated character of this evolution, as it will be possible to discover the main lines of the evolution in the generic contradistinctions, and the secondary tendencies of differentiation and specialisation in the morphological evidences of the established groups, without being compelled t o t i e, a p r i o r i, t h e s y s t e m a t i c a l c l a s s i f i c a t i o n t o e v o l u t i o n a r y s u p p o s i t i o n s, as it is very often done in the existing nomenclature. WELLER, for instance, in a recent publication (1937) considers the genera he previously (1936) established as true stages of evolutive development.

As a matter of fact our knowledge of the evolution of the permo-carboniferous trilobites is by far too imperfect ,that we can found upon it a systematical classification, for it is obvious that the evolution (or degeneration?) expressed in the extreme specialisation of the dying trilobites did not affect one single organ, but is generally shown by the migration of one organ and at the same time by the reduction of a second and the evident development of other ones. The tendencies discovered did hitherto not succeed in defining the correlations, possibly existing in the evolutive behaviour of the different organs, involved in the general evolution.

For all these reasons, emphasized by the deficiency of the permo-carboniferous stratigraphy (at least with regard to the trilobites) it is, for the moment, wholly impossible to state with sufficient security:

1°. if the related splitting of the trilobite group at the end of the palaeozoic era, produced new genera, distinct species or only slightly different varieties, between which all possible transitions could be discovered. From the general aspect of these faunas I might encline, as already said, to the assumption of a specific differentiation.

2°. the direction of the evolution in such cases, where we decidedly have to do with morphological features, showing close relations of doubtless evolutive significance;

All these questions are necessarily involved in a revision of the permo-carboniferous trilobites and, since on account of the confusion existing in their nomenclature, it is imperative that new descriptions should be founded upon such a revision, I was compelled to undertake the latter, even in circumstances, wherein it could be but very incompletely done. Such a revision must be preceded by a critical discussion of the genera and species hitherto described together with a critical discussion of the morphological characters, considered by earlier writers as typically discriminating features of generic, specific or individual importance. Moreover I will have to discute, where necessary, the terms, notions and presentive words, used in previous definitions and descriptions.

II. CLASSIFICATION AND EVOLUTION OF THE PERMOCARBONIFEROUS TRILOBITES

In such a discussion are mainly to be concerned here the genera of which representatives have hitherto been discovered in permian beds and such carboniferous genera whose knowledge is essential for the comprehension of these permian genera. They can be chronologically listed as follows:

Proetus STEININGER 1831.
Phillipsia PORTLOCK 1843 (emend. J. M. WELLER 1936).
Griffithides PORTLOCK 1843 (emend. J. M. WELLER 1936).
Brachymetopus MCCOY 1847.
Pseudophillipsia GEMMELLARO 1892.
Cheiropyge DIENER 1897.
Anisopyge GIRTY 1908.
Neoproetus TESCH 1923.
Ditomopyge NEWELL 1931 (emend. J. M. WELLER 1936).
Cyphinium WEBER 1933.
Neogriffithides TOUMANSKY 1935.
Paraphillipsia TOUMANSKY 1935.
Permoproetus TOUMANSKY 1935.
Exochops J. M. WELLER 1936.
Paladin J. M. WELLER 1936.
Kaskia J. H. WELLER 1936.
Sevillia J. M. WELLER 1936.
Ameura J. M. WELLER 1936.

With the possible exception of *Brachymetopus* MCCOY, brought by RICHTER (1926*b*) to a separate family, the *Otarionidae*, they all belong to the family of the *Proetidae*. The separation of a second independent family, the *Phillipsiidae*, was mentioned by VODGES (1890 p. 83) to include the genera *Phillipsinella* NOVÄK 1885, *Phillipsia* PORTLOCK 1843 and *Griffithides* PORTLOCK 1843. Such family can however not be founded upon sufficient justifications, on account of the evident relationship between *Phillipsia* PORTLOCK

and *Proetus* STEININGER. In another connection we will come back upon this suggestion.

The genus ***Proetus* Steininger,** one of the most interesting genera among all trilobites was beautifully revised by RICHTER. Its stratigraphical and systematical position rather rapproach it to silurian and devonian forms. It is only concerned here in as much as a few representatives have also been discovered in permo-carboniferous beds and its contradistinctions from *Phillipsia* PORTLOCK are often essential for the discrimination of the latter.

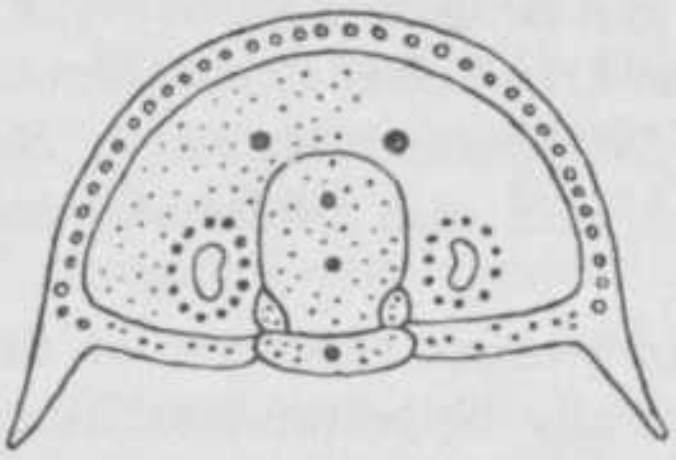
1. *Brachymetopus* McCoy 1847 and *Cheiropyge* Diener 1897.

Brachymetopus McCOY is the best defined of all permo-carboniferous genera and gave hitherto no opportunity to confusion. The divergences of opinion rather concern its belonging to the family of the *Proetidae* or to that of the *Otarionidae* to which it was reckoned by the RICHTERS (1926), on account of its possible descent from *Cyphaspis*. It was founded, as its author expressively designated "upon numerous specimens of the Australian species" *Brachymetopus strzeleckii* McCOY, which has therefore to be considered as the genotype. WELLER's statement (1936 p. 705), probably founded upon informations of VODGES (1890 p. 83 and 99) that *Brachymetopus* (= *Phillipsia*) *maccoyi* PORTL. was made the type of the genus is erroneous. The original diagnosis as given by MACCOY (1847 p. 229) may be reprinted here, with regard to the rarity of its first publication:

> Cephalothorax truncato-orbicular; limb narrow, produced backwards into flattened spines; glabella smooth, c y l i n d r i c a l o r o v a t e, about twice as long as wide, not reaching within about its own diameter of the front margin; one pair of small, basal, cephalothoracic furrows, or none. Eyes reniform, in the midst of the cheeks (? smooth); eye-lines unknown; surface strongly granulated, one tubercle on each side of the anterior end of the glabella, the marginal row and a circle round each eye being larger than the rest. Body segments unknown. Pygidium nearly resembling the cephalothorax in size and form, rather more pointed, strongly trilobed, and with a thickened prominent margin; axal lobe about as wide as the lateral lobes, of about seventeen narrow segments; lateral segments about seven, divided from their origin, each terminating in a large tubercle at the marigin.

It was soon recognized that this diagnostical summary, evidently furnished by the morphological characters of the australian genotype did not completely apply neither to *Brachymetopus maccoyi*

nor to *Brachymetopus discors*, species MACCOY nevertheless reckoned to his new genus. The fact that the former was only known to him from a cephalon and the latter was represented in his materials by a lose pygidium is worthy to be noted here, as it may perhaps afford



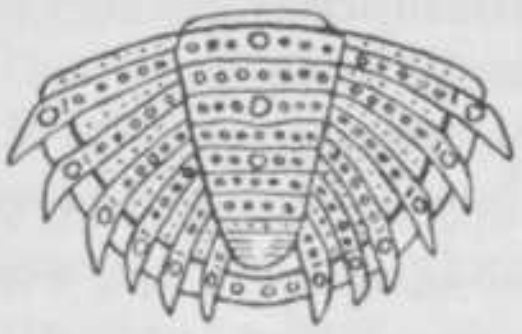


Fig. 1.

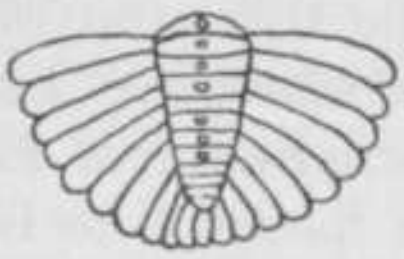


FIG. 2

FIG. 3

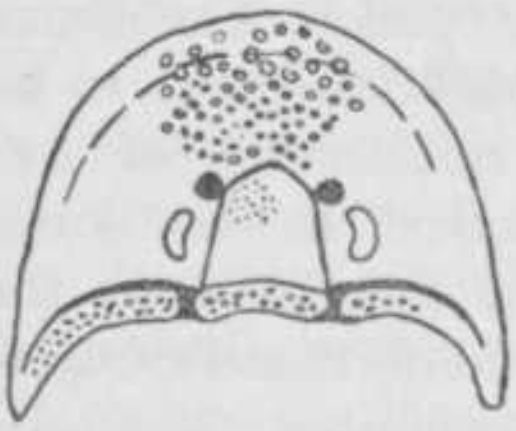


FIG. 4

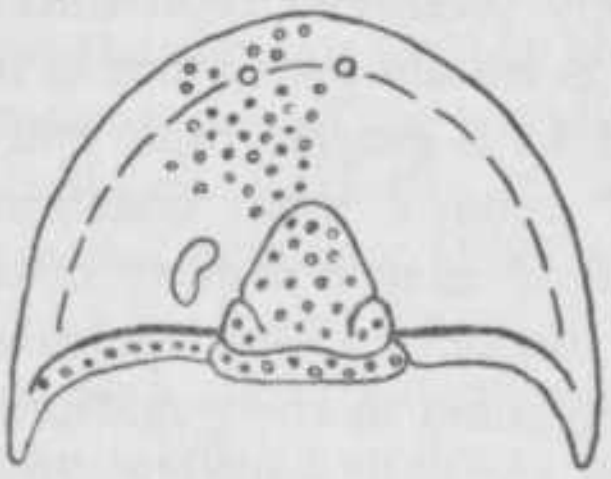


FIG. 5

FIG. 6.

FIG. 1. Cephalon and pygidium of *Brachymetopus Strzeleckii* MCCOY.
FIG. 2. pygidium of *Brachymetopus hibernicus* WOODW.
FIG. 3. Cephalon and pygidium of *Brachymetopus maccoyi* PORTL.
FIG. 4. Cephalon of *Brachymetopus densituberculatus* WEBER
FIG. 5. Cephalon of *Brachymetopus ornatus* WOODW.
FIG. 6. Pygidium of *Cheiropyge himalayensis* DIEN.

some solution to the questions afterwards opened by different palaeontologists in connection with the genus *Brachymetopus*. It indeed proves that MACCOY became to sight the most differing specimens of *Brachymetopus*, whose heterogenity was afterwards questioned.

WOODWARD (1884), herein followed by VODGES (1887) and others, gave a largerly emended diagnosis, differing somewhat from that originally established by MACCOY, being modified in such a way as to include the european species *Br. ouralicus* DE VERN., *Br. maccoyi* PORTL., *Br. discors* MCCOY and *Br. hibernicus* WOODW., and likewise the north-american species of the Lower-Carboniferous Waverly-group: *Br. lodiensis* MEEK, *Br. spinosus* HERRICK, *Br. armatus* VODGES, *Br. immaturus* HERR. and also *Brachymetopus* (= *Dalmanites*?) *cuyahogae* CLAYPOLE.

According to REED (1903) the heterogeneous character of the genus *Brachymetopus* would systematically be better established by the contradistinction of two separate subgenera:

1°. the first, for which the name ***Brachymetopina*** was suggested, should accomodate the european species with the type *Brachymetopus* (*Brachymetopina*) *maccoyi* PORTL. (fig. 3);

2°. the second, ***Brachymetopus s.s.*** accomodating the spinigerous australian species is to be founded upon the evident genotype *Brachymetopus* (*Brachymetopus*) *strzeleckii* MCCOY (fig. 1).

The distinguishing of two separate subgenera among the few and too incompletely preserved representatives of *Brachymetopus* hitherto described ,is wholly premature in my opinion. A subgenus is too easily raised to a generic rank and ought therefore to be clearly established upon a more constant combination of s e v e r a l, independent morphological characters. In the case, treated here, this distinction was exclusively founded upon the fewer number of segments in the pygidium and the raised spinigerous border, which would separate *Brachymetopus strzeleckii* from all the European forms.

a. The geographical argument signalled by VON MÖLLER (1867) and CLAYPOLE (1884) and tacitly brought up by REED is of no value, since spinigerous pygidia were more recently discovered in the Upper-Devonian *Gonioclymenia*-beds of France and Germany and rightly described by RICHTER (1926*b* p. 105) as *Brachymetopus* (*Brachymetopus*) *péneaui*.

b. The systematical use of the spinosity or crenulation of the pygidial margin, although sufficiently reliable in the identification of species, is very doubtful in generic contradistinctions, as we have many other trilobite-genera with spinose and non-

spinose representatives. The genus or subgenus *Phaëtonides*, mentioned by REED in support of his opinion, was but "p a r t-l y" distinguished for analogous reasons from the typical *Proetus* and can therefore not prove against the objections, formulated here.

c. It is true that with regard to the peculiar pygidial characters we can casely distinguish a m o n g t h e s p e c i e s d e-s c r i b e d b y M a c C o y, between two different types of pygidial development:

1°. a spinose s t r z e l e c k i i-t y p e (fig. 1) with few axial segments, and

2°. an entirely even outlined m a c c o y i-t y p e (fig. 3) with a larger number of axial segments;

but in comparing among the species ulteriorly brought to *Brachymetopus* it is evident that such a distinction would soon necessitate the foundation of at least one other type viz. subgenus, since on closer examination, it seems practically impossible to bring the strikingly different spinose character of the pygidium in *Br. strzeleckii* (fig. 1); *Brachymetopus* (= *Dalmanites*) *cuyahogae* CLAYPOLE (1884 p. 79 fig. 6); *Br. péneaui* RICHTER (1926*b* pl. 6 fig. 88) and *Br. armatus* VODGES (1892 pl. XV fig. 5) to one and the same or even to closely related types.

Especially the configuration of the pygidial outline in *Br. hibernicus* WOODW. (1884 pl. VIII fig. 16) and *Brachymetopus* (= *Phaëtonides*) *spinosus* HERRICK (1891 pl. I fig. 13) would determine a third type, h i b e r n i c u s (fig. 2) as it might be called, characterized by a slightly crenulated marginal border (without spines) and a median number of axial segments. This may be more summarily shown in the following table, where the species hitherto described have been arranged according to the increasing number of segments in their pygidial axis:

Brachymetopus	Segments in the Axis	Segments in the Lat. Lob.	Pygidial Type	Age	Remarks
discors McCoy. . .	17	6	**Maccoyi**	carb.	
ornatus Woodw.. .	17	8	id.	id.	
maccoyi Portl. . .	15	8	id.	id.	
ouralicus de Vern .	14	9	id.	id.	de Verneuil 1845 p. 378 and Woodward 1884 p. 49.
lodiensis Meek. . .	12-13	6-7	fimbriated or entire	upper Lower carb.	
spinosus Herrick. .	13	12	**Hibernicus**	id.	
hibernicus Woodw..	11	10	id.	carb.	
armatus Vodges . .	11-(12?)	6-7	fimbriated with a single pair of spines	carb. or devonian	Vodges 1892 p. 617 pl. XV fig. 4 and 5. The figures are very defective and not to be relied on.
cuyahogae Claypole	11-12	10	**Strzeleckii**	upper Lower carb.	
strzeleckii McCoy .	9-10	6-7	id.		
péneaui Richter . .	7-8	6-7	id.	upper devonian	

The pygidia and other materials hitherto obtained, are too few and too fragmentary, that any conclusion might be drawn from this synoptical table, whose suggestions both in systematical and stratigraphical connection, must at first be controlled by subsequent findings of larger materials. With regard to the pygidial evolution it would for instance be of particular interest to know more about the youngest representative *Brachymetopus sp.*, TOUMANSKY (1935) described from the permo-carboniferous beds of Crimea, whose pygidium, by exhibiting a larger number of axial segments, would strengthen the presumption, raised by the few number in the devonian species *Brachymetopus péneaui* RICHTER, that this number has been continually increasing during the latest palaeozoic times. A supposition corroborated, as we will see, by analogous tendencies in other permo-carboniferous genera.

In another connection a closer investigation of *Brachymetopus lodienses* MEEK from the North-American Waverly-Group is also imperatively wanted here, as it might prove the tran-

sitional position of this form between types with slightly crenulated and such ones with entirely even outlined pygidial margin, since it is highly surprising that just this species should be represented both by very slightly fimbriated (MEEK 1875 p. 324) and entirely plane pygidia (CLAYPOLE 1884 p. 78). This is the more surprising as an analogous transitional behaviour seems to be indicated between the spinose strzeleckii-type and the slightly fimbriated hibernicus-type. There the position of *Brachymetopus armatus* VODGES is also doubtessly fixed by the number of axial segments in the pygidium and by the aberrant morphology of the pygidial margin. As concerns the latter, the marginal depression indicating a distinct limb and the two posterior ribs being prolonged into spines rapproach *Brachymetopus armatus* to the spinigerous genotype, *Brachymetopus strzeleckii*. The anterior ribs, on the other hand, extending on the limb and terminating with a node, confer to the concerned pygidium a close resemblance to *Brachymetopus lodiensis* MEEK, thus rapproaching it to the slightly fimbriated forms of the hibernicus-type. Such transitions, as probably are existing here, surely press for prudence in the separation of distinct subgenera, as proposed by REED, since they seem to indicate that such contradistinctions would rather be unnatural ones and finally lead to artificial classifications.

d. Yet there are other morphological features to be reckoned with in eventually contradistinctions of separate subgenera in the genus *Brachymetopus*. The presumed heterogeneous character of this genus is not less evident in the peculiar characters of the cephalic shield and especially in the general configuration of the glabella. These features were considered by REED of lower classificatory value, though MACCOY mentioned them as generic characters. In both REED's genotypes, the differences in the pygidia are effectively congruent with such ones in the cephalic shields, thus seemingly corroborating the subgeneric contradistinctions:

In *Brachymetopus strzeleckii* (fig. 1) the cephalon is character ized by a cylindrical or ovate glabella (subcylindrical according to REED), by a typical circle of tubercles round the eyes, a pair of large tubercles at the front end of the glabella and large median tubercles on the glabella itself.

In *Brachymetopus maccoyi* (fig. 3) the glabella is more truncated conical in form, rounded in front and laterally bounded by straight, forwardly constricting furrows (compare for instance WOODWARD 1884 pl. VIII fig. 10). The cephalon is furthermore deprived of the typical tuberculation of *Brachymetopus strzeleckii*. But this congruency between cephalic and pygidial features seems not to be constant in the species ulteriorly described. There is at first the doubt arisen around *Brachymetopus ouralicus* DE VERN., According to REED the headshield, figured in VON MÖLLER (1867 t. 11 fig. 32), which shows the circle of tubercles round the eyes, the pair of large tubercles in front of the glabella and one median tubercle on the glabella (which are all features well-marked in *Brachymetopus strzeleckii*) should have been doubtfully attributed to *Brachymetopus ouralicus*. I can however not agree with REED, since his statement obviously bases upon a comparison among the russian and english representatives of *Brachymetopus ouralicus*, and such a comparison, as a matter of fact, is very doubtful. In this connection attention may be drawn upon VON MÖLLER's supposition (1867 p. 27) that the specimens of Derbyshire, identified with *Brachymetopus ouralicus* are quite different from the typical uralian form and therefore belong to some other species, and upon WOODWARD's supposition (1884 p. 52) to adopt for the english form the name *Brachymetopus ornatus*, when on fuller information, it should be necessary to separate the Russian species, for which, of course, the original name of *ouralicus* must be retained. This fuller information is afforded now, as I believe, by the more recent investigations of WEBER, who described a cephalon of *Brachymetopus densituberculatus* WEBER (1933 p. 75 pl. I fig. 46) from the Carboniferous beds of the Donetz Basin, and rapproached it to *Brachymetopus ouralicus* DE VERN, so as to doubt even of its being only a variety of the latter. As this new russian species remarkably exhibits also a pair of large tubercles at the frontal part of the glabella (fig. 4) and shortened genal spines, we must accept that the Russian forms effectively belong to a distinct and more highly ornamented species, as was one of WOODWARD's suppositions (1884 p. 51). This interpretation would not only explain the fact, that in the pygidium of the uralian species only 14 axial

and 9 lateral segments were counted (DE VERNEUIL 1845 p. 378), while WOODWARD (1884 p. 49) observed 17 coalesced segments in the pygidial axis of the English specimens and 8 ribs in their lateral lobes; but it is moreover evidently corroborated by the striking differences in the general configuration of the glabella. In the Russian representatives the glabella is truncated conical in form and more angular in front (fig. 4). In *Brachymetopus ornatus* WOODWARD, the glabella is obtusely conical, almost triangular in form and rounded in front (fig. 5), thus remembering the analogous behaviour of the glabella in the genera *Dechenella* and *Cyrtosymbole*, where the forwardly constricting of the glabella has been considered as a "rejuvenation" (= Verjüngter Glatze" cfr. RICHTER 1926*b* and SCHMIDT 1929 p. 77). As both these glabellar forms are quite different from those in the related genotypes, I believe it as wholly premature to make any systematical distinction, the more as the ornamentation and tuberculation in the cephalon of the Russian species point to probable transitions to *Brachymetopus strzeleckii*, notwithstanding the fact their pygidia rapproach them to the maccoyi-type.

A remarkable exception among the trilobites with spinigerous pygidial border is represented in the himalayan species, ***Cheiropyge himalayensis* Dien.** from the permocarboniferous limestone of Chitichun no. 1 (DIENER 1897 p. 5 pl. I fig. 2*a-c*). *Cheiropyge* DIENER founded upon a single lose pygidium has been identified by several authors (cfr. WEBER 1933) with the genus *Brachymetopus* MACCOY, where, on account of its spinose nature the himalayan species should have to be referred to REED's subgenus *Brachymetopus* s.s. or to my s t r z e l e c k i i-group. In none of these classifications it can however be satisfactorily ranged, since the number of its pygidial segments (15 in the axis and 6 in the lateral lobes) rather rapproaches it to the subgenus *Brachymetopina* REED or to my m a c c o y i-group. Among the other characteristics there are however remarkable peculiarities preventing for the moment the complete identification with *Brachymetopus* MACCOY:

1°. the size seems at first to be much larger than that of all other representatives of *Brachymetopus*;

2°. the ornamentation of the lateral lobes, schematized in fig. 6, is apparently also a quite different one, consisting of an i r r e-

gular tuberculation with numerous rounded granules, while in *Brachymetopus* the lateral lobes are regularly ornamented with large, lineary arranged tubercles, similar to those of the axial segments.

3°. the segmentation itself is entirely different in the pleural lobes. In the spinose *Brachymetopi*, there is always a definite alternation to be seen caused by alternating longer and shorter spines (*Br. cuyahogae*); highly ornamented ribs and slightly tuberculated grooves (*Br. strzeleckii*); well-developed anterior and posterior segmental bands (RICHTER's "Vorder- und Hinterbänder") *Br. péneaui* RICHTER (1926*b* Taf. 6 fig. 88*a*) In *Cheiropyge himalayensis* there is not the slightest indication of such alternating features. In *Brachymetopus* the lateral segments are regularly shaped over their whole length and pointed at their extremities. In *Cheiropyge* the pleural ribs broaden considerably as they approach to the margin and are rounded at the external edge.

4°. The caudal termination by an axial lappet of the size and form as in *Cheiropyge himalayensis* is a feature unknown in all the representatives of *Brachymetopus*.

For all those reasons, I prefer to follow DIENER's advice and to await the discovery of other parts of the carapace for a complete diagnosis of the genus *Cheiropyge* or for the identification of the latter with *Brachymetopus* MACCOY. Should a brachymetopid cephalon be discovered, then I might rapproach this species to the related *hibernicus*-group, since the broadening and rounding of the lateral segments, followed by a corresponding dispersion of the originally lineary-arranged granulations might constitute a remarkably aberrant transition from pointed-spinose to roundly fimbriated pygidia. But there would also be the possibility that this permian species represents a tardy differentiation of the lower-carboniferous spinigerous forms. The intermediate number of axial segments points in both directions.

2. Phillipsia Portlock 1843.

The confusion existing in the nomenclature of the permo-carboniferous trilobites is mainly founded upon the striking affinities between the genera *Phillipsia* and *Griffithides*, both proposed by

PORTLOCK in 1843 on the base of Lower Carboniferous specimens. PORTLOCK did not designate genotypes nor directly compare these genera, but from a discussion of the original diagnoses, reprinted here, it may nevertheless be possible to detect his intentions:

***Phillipsia* Portlock**	***Griffithides* Portlock**
General form oval.	Cephalothorax, semi-oval, longitudinal.
Glabella bounded on the sides by nearly parallel lines; rounded in front; the general form approaching to cylindrical; marked on the sides by 3 sets of segmental lines.... which are not present in Proetus.	Glabella strongly marked and gibbous; rounded in front, narrowed posteriorly into an obsolete neck, with a furrow more or less distinct on each side.
The first from the base of these lines is rounded so as to include a circular space....	
The second is also slightly curved.	
The third is nearly straight.	
Between the two sets of lines there is a space equal to more than one third the whole breadth of the glabella.	
The cheeks, slightly convex, in form spherical triangles.	Cheeks, triangular spaces, very slightly convex.
Eyes lunate, situated on the cheeks, but very near to the glabella, to the axis of which their chord or longer axis is parallel. Surface under a magnifier very finely reticulated.	Eyes near the axis, not large lunate.
Neck-furrow deep.	Smooth?
	The minute neck-tubercle is sometimes present.
Wings, or margin, separated from the front and cheeks, by an imperfect line or furrow which is connected with the neck-furrow, and end posteriorly in sharp angles more or less prolonged as spines.	Wings, either ending in an angle posteriorly or prolonged backwards in a flattened spine.
The margin is turned down, and forms, on the under surface a narrow striated rim.	
Thorax composed of 9 segments. The pleuripedes are compound.	Thorax: the pleuripedes are compound, in number 9 or, with the neck-segment, ten.
Pygidium exhibiting, both in the axal and lateral lobes, distinct segments, by which it is further separated from Proetus.	Pygidium fully developed and strongly resembling that of Phillipsia.
The axal lobe and the lateral segments do not extend to the external edge, but have a considerable marginal space.	

It should at first be remarked here, that PORTLOCK did not attach any systematical importance to the morphological features exhibited by the pygidium. In an additory remark to his description of *Phillipsia*, he stated that the genus could not be satisfactorily determined from a specimen of the pygidium alone. He thus discriminated the genera *Phillipsia* and *Griffithides* upon the peculiarities of the cephalic shield and more especially upon the particular characters of the glabella.

Although I wholly agree with those palaeontologists (VODGES 1890 p. 83; WELLER 1936 p. 704), who consider *Phillipsia Kellii* PORTL. (1843), afterwards identified with *Phillipsia* (= *Asaphus*) *gemmulifera* PHILLIPS (1386) as the type of the genus, we must admit that the diagnosis of *Phillipsia* PORTLOCK was in its general formulation, effectively founded upon the species PORTLOCK described as belonging to his new genus. These were:

(*Phillipsia Kellii* PORTL.) = *Phillipsia gemmulifera* PHILL.

(*Phillipsia ornata* PORTL.) = *Phillipsia truncatula* PHILL.

(*Phillipsia jonesii* var. *seminifera* PORTL.) = *Phillipsia derbiensis* MARTIN.

Phillipsia maccoyi PORTL.

Of these, *Phillipsia maccoyi* has not to be discussed here, since PORTLOCK himself placed it only p r o v i s i o n a l l y in this genus and it was afterwards brought, as already said, by MACCOY to the newly founded genus *Brachymetopus*. The more important is however the discussion of the other species, as their specific contradictinctions were recently involved in emendations of the diagnosis of *Phillipsia* PORTLOCK and consequently in the discrimination of new genera. According to WELLER (1936) the heterogeneous nature of the genus *Phillipsia* should have been so evident, that it was very soon recognized. This can however be doubted and the transfer of *Phillipsia maccoyi* to *Brachymetopus* is surely not a sufficient proof for this statement (cfr. WELLER 1936 p. 705). Yet it is true that among the species described by PORTLOCK, we could easely distinguish between two types of glabellar development:

1°. a g e m m u l i f e r a-t y p e in *Phillipsia gemmulifera* and *Phillipsia truncatula*

2°. a d e r b i e n s i s-t y p e in *Phillipsia derbiensis* MARTIN.

The first (fig. 9) is characterized by a glabella, which, according to PORTLOCK, is "convex, elongated, even in front with the cheeks, but

not extending to the edge of the margin; rounded in front; at the sides bounded by lines nearly parallel, yet with a slight curvature inwards".

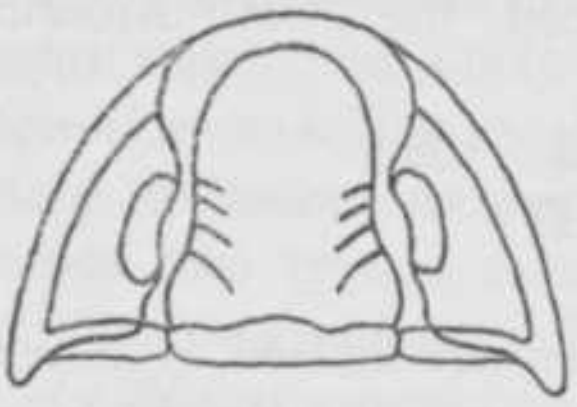


FIG.7

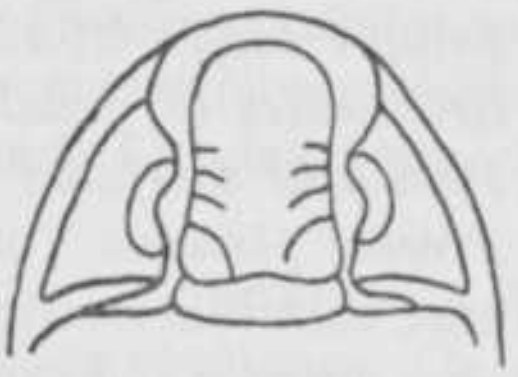


FIG.8

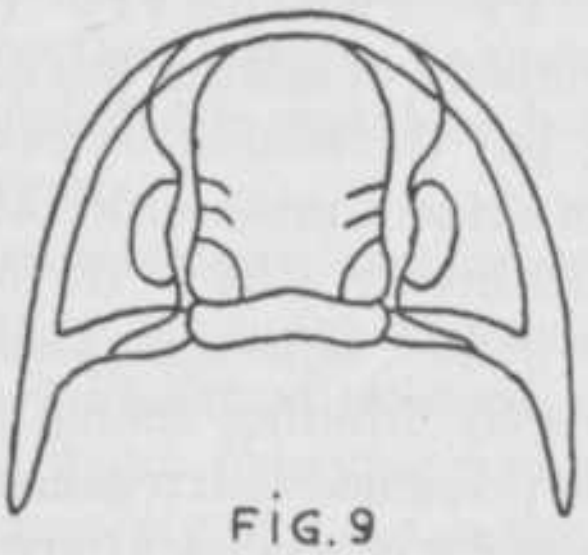


FIG.9

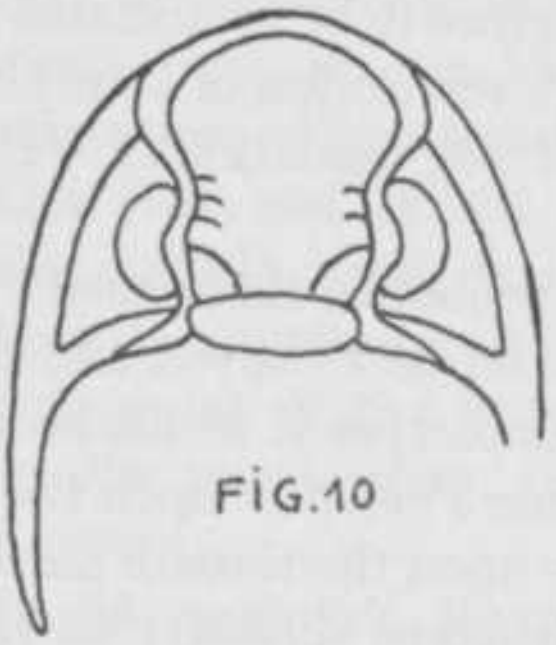


FIG.10

FIG.11

FIG. 7. *Phillipsia trunculata* PHILL. *var. mansuyi* HOFF.
FIG. 8. *Phillipsia truncatula* PHILL.
FIG. 9. *Phillipsia gemmulifera* PHILL.
FIG. 10. *Phillipsia eichwaldi* FISCHER.
FIG. 11. *Phillipsia derbiensis* MART.

The second (fig. 11) is characterized by a glabella of whicht PORTLOCK stated "rounded in front; about the middle it is very much drawn in or contracted, which is an excellent specific character. Anteriorly it appears to extend to the outer edge of the margin, but in realty a fine line marks the

continuance of the margin over the front".

WELLER (1936 p. 706) now proposed to restrict the genus *Phillipsia* to accord with the characters of the gemmulifera-type and referred to the genus, thus redefined, the North American species *Proetus swallovi* SHUMARD 1855.

Griffithides (?) *sedalienses* VODGES 1888.
Phillipsia sampsoni VODGES 1888
Proetus placidus VODGES 1896.

I feel sure that this restriction, too narrowly limited, is inappropriate to the purpose and can, by no means, afford a clearly defined status of the concerned genus. I agree with WELLER that the genus *Phillipsia* PORTLOCK, as currently interpreted is rather an artificial assemblage of more or less diverse and not closely related trilobite-types, but the restriction as proposed by him effectively bases upon an evident misinterpretation of the intentions of PORTLOCK and undoubtedly affords the opportunity to much greater confusion, as it, in fact, separates closely related species into several new genera, wholly differing among them. The confusion actually existing in the presumed heterogeneous genus was mainly caused by the great diversity of species, afterwards erroneously brought to *Phillipsia* and ought therefore to be remediated by a critical revision of those species, not by a restriction of PORTLOCK's diagnosis itself,which was, as we will see, remarkably well established.

WELLER for instance thinks it highly probable, that one of PORTLOCK's species, *Phillipsia derbiensis* should be removed and made the type of a new genus. On closer examination it seems however evident, that PORTLOCK intended to define *Phillipsia* upon the base of the form of the glabella and especially upon the sinuate nature of its laterally bounding furrows, whose different sinuosity he rather considered as a feature of specific value. This may be deduced from his description of *Phillipsia gemmulifera*, where he expressively remarks that the glabella, although bounded by lines nearly parallel, shows laterally a slight curvature inwards and still more emphatically in his description of *Phillipsia derbiensis*, whose glabellar contraction he considered as "an excellent specific character". Thus interpretated, *Phillipsia derbiensis* should not only be maintained in the genus *Phillipsia*, but has moreover to be considered as a second genotype of the latter,

since it exhibits, more clearly, than *Phillipsia gemmulifera* the sinuate configuration of the phillipsid glabella.

PORTLOCK's viewpoint and its interpretation as formulated here, seem to be corroborated by several subsequent descriptions of species, which, doubtessly belonging to *Phillipsia*, exhibit, in several connections as will be shown afterwards, transitional glabellar types. Among the numerous species, which could be related here, I might mention two typical ones:

1°. *Phillipsia eichwaldi* FISCHER (fig. 10) intermediate between *Phillipsia gemmulifera* and *Phillipsa derbiensis*. On account of its anteriorly expanding glabella it could not be reckoned to *Phillipsia*, as restricted by WELLER, and in differing from *Phillipsia derbiensis* by the presence of a distinct flat marginal band anterior to the glabella, it would probably also constitute the type of a new genus.

In WELLER's classification at least three separate genera should thus be necessary to accommodate such species as *Phillipsia gemmulifera* (fig. 9) *Phillipsia eichwaldi* (fig. 10) and *Phillipsia derbiensis* (fig. 11), which, in having in common, but one constant peculiarity (the sinuosity of the glabellar outline!) show for the rest, remarkably gradual transitions in all other morphological characters: in the length and position of the eyes; in the migration of the facial suture towards the glabella (cf. WELLER 1937 and WANG 1937 p. 367!) and in the expansion of the glabella itself. It is extremely remarkable that these directed transitions are also accompanied by a gradual development of the flattened band anterior to the glabella.

In *Ph. gemmulifera*, the glabella reaches but to the marginal furrow;

In *Ph. eichwaldi*, the glabellar front covers half the marginal border;

In *Ph. derbiensis*, the glabella lies at one level with the frontal rim.

This conclusion encroaches essentially upon WELLER's classification, wherein great value is laid upon this flattened band as a discriminating feature of generic importance.

2°. *Phillipsia truncatula* Phill. *var. mansuyi* Hoffet (1931 p. 655 pl. XXXV) (fig. 7) (= *Phillipsia cf. propinqua* MANSUY (1919 p. 35) (= *Ph. propinqua* MANS. var. *nongpoensis* PATTE (1922 p. 15) from the lower-Carboniferous beds of Indo-China.

Considered by its author as a variety of *Phillipsia truncatula*, it exhibits a glabella, bounded by forwardly constricting furrows, yet with a slight curvature inwards (fig. 7). Although it can be doubted that this species was rightly identified with *Phillipsia truncatula* and it, out of prudence, would surely have been better to consider it rather as an independent species (which should, of course, be termed *Phillipsia mansuyi* HOFFET), the general morphological relations to *Phillipsia truncatula* are evident, especially since it can easily be seen in WOODWARD's figures, that the latter possesses also a glabella, which is slightly constricting towards the front. In *Phillipsia mansuyi* HOFF. this forwardly constricting is so evident that this species can by no means be brought to WELLER's emended genus and would therefore also constitute the type of a new genus, notwithstanding its close relations to *Phillipsia truncatula*, which has been considered by WELLER as a true representative of *Phillipsia* PORTLOCK, (emend. J. M. WELLER).

As a matter of fact *Phillipsia mansuyi* HOFF. was mentioned here as illustrative for such species with phillipsid glabella, which exhibit at the same time a forwardly constricting of this glabella. As such, it should for instance be compared with *Phillipsia sangamonensis* MEEK and WORTHEN, with whom was identified *Phillipsia missouriensis* SHUMARD (1858 p. 225 and VODGES 1887 p. 86 pl. 3 figs 1—2). (cfr. WELLER 1936, p. 713, who founded upon it his new genus *Ameura*).

From those remarks, mainly founded upon PORTLOCK's genotypes, it results, that since PORTLOCK unfortunately disposed but of specimens, whose glabella was laterally bounded by furrows, which in their g e n e r a l c o u r s e were "n e a r l y p a r a l l e l", the original diagnosis of *Phillipsia* PORTLOCK can sufficiently be accorded to modern standards by substituting this descriptive detail by a more appropriate definition of the form of the phillipsid glabella, which is effectively bounded by s i n u a t e f u r r o w s c u r v i n g i n w a r d s, a t a b o u t t h e m i d d l e o f t h e g l a b e l l a.

The interpretation given here to PORTLOCK's diagnosis of *Phillipsia* is also corroborated by several observations on trilobites, described by earlier writers as representative for *Phillipsia* and brought by modern investigators to new or to wholly different genera. It is highly remarkable that most of these often-transferred

species have a sinuate glabella, similar to that, which I am enclined to require diagnostically for PORTLOCK's genus. I therefore feel convinced that earlier writers must have had in mind the interpretation of PORTLOCK's diagnosis as given here, whilst in modern times differing norms were applied in the determination of permocarboniferous trilobites. This may briefly be proved by such species as:

1) *Phillipsia sicula* GEMM. In the descriptive part of this work attention is drawn upon a secondary pyriform differentiation of this doubtless phillipsid glabella. GEMMELLARO rightly recognized the phillipsid character of the glabella and apparently considered of less value the pyriform differentiation of the latter. TESCH (1923) and especially TOUMANSKY (1935) attached more importance to the pyriform character. The latter considered *Phillipsia sicula* GEMM. as representative for a separate genus and made it the genotype of *Neogriffithides*. It will afterwards be shown that there probably are no sufficient reasons to maintain *Neogriffithides* TOUMANSKY as an independent genus; the latter constituting essentially a small group of strongly specialised and strangely decayed permian trilobites closely related to *Phillipsia* PORTLOCK, from which it is believed to have ultimately sprung.

2) *Phillipsia sangamonensis* MEEK and WORTHEN (1873 p. 615) which was described as having a glabella "s l i g h t l y wider between the eyes than anteriorly" with sides "nearly parallel, but a little sinuous at the middle". In my opinion this species was therefore rightly brought to *Phillipsia* notwithstanding the remarkable development of aberrant basal lobes. WELLER's statement (1936 p. 714) that the genus *Ameura*, essentially founded upon *Phillipsia sangamonensis*, should be clearly defined by the form of its glabella, which, in WELLER's opinion (cfr. WELLER 1937 fig. 1), is "much the widest between the eyes" cannot be satisfactorily proved since no new description has been given and earlier data are very doubtful in this connection or even contradictory. Compare for instance *Phill. missouricnsis* SHUMARD in VODGES (1887 pl. 3 fig. 1 and 2). This species presumedly identical with *Ph. sangamonensis* exhibits a glabella, which is doubtlessly constricting towards the front, everyway under preservation of its lateral sinuosity.

I agree with WELLER that the European form *Phillipsia*

eichwaldi Fischer (fig. 10) is suggestive for *Ameura* in several respects. This fact rather proves the prematureness of separatting such closely connected and probably transitional species into different and uncertain genera.

3) *Phillipsia trinucleata* HERRICK (1887 p. 64 pl. 1 fig. 23; pl. 2 fig. 32; pl. 3 fig. 21) brought to *Proetus* STEININGER by VODGES (1887 pl. 81 pl. 2 fig. 7 and 9) notwithstanding its large number of pygidial segments (17 to 19 in the axis and 9 to 12 in the pleural lobes!). It was considered by WELLER (1936 p. 712) as representative for his new genus *Sevillia*. This species, whose glabellar sides are "nearly straight or somewhat concave near the eyes" was rightly brought to *Phillipsia* by its author; but according to modern standards a restriction should be made in this determination on account of the presence of "cervical" lobes (praeoccipital and postero-lateral lobes), since these lobes are considered by WEBER (1933) as an important particularity in generic viz. sub-generic discriminations. In the discussion of the "shortened glabella" we will come back upon this species and rapproach it to evolutionary younger representatives of the genus *Phillipsia* for which a new subgenus *Neophillipsia* is to be established.

In this interpretation and new formulation of PORTLOCK's diagnosis, the genus *Phillipsia* surely is a very heterogeneous one and doubtessly includes a great diversity of species but, for the moment, there is no reliable standard to subdivide it, neither in different genera, nor in systematically equivalent subgenera. The genus being characterised by a sinuate glabella, it might provisionally seem suitable to take into consideration the distinction of three large groups among the species brought to *Phillipsia* PORTLOCK.

1°. the group of *Phillipsia mansuyi*, with forwardly constricting glabella;
2°. the *gemmulifera-group* with an almost cylindrical glabella, and
3°. the *eichwaldi-group* with an anteriorly expanded glabella.

Such a contradistinction might, at first sight, show a remarkable analogy to the recently established subdivision of the genus *Proetus* STEININGER (cfr. RICHTER and SCHMIDT); but this can never prove against it, since several authors have ascertained that the genus *Phillipsia* doubtessly includes a great number of species, which should better be reckoned to *Proetus*.

3. Griffithides Portlock 1843

The genus *Griffithides* was founded by PORTLOCK, without expressive designation of a genotype, upon the description of the following species:

Griffithides longiceps PORTLOCK (fig. 12)
Griffithides globiceps PHILLIPS (fig. 13)
Griffithides platyceps PORTLOCK
Griffithides longispinus PORTLOCK

Of these, *Griffithides platyceps* is too badly preserved and figured and too insufficiently described that a critical discussion might be given of its morphological characters. In all PORTLOCK's species however, the so-called "basal" furrows are always strongly marked and relatively broad, separating distinct basal lobes from the rest of the glabella, which is always "pear-shaped". (The last term to be taken in its broadest sense). I am enclined to consider this feature as the most typical character of *Griffithides* PORTLOCK. Anticipating some remarks to be made ulteriorly, I might therefore define the genus *Griffithides* by the general configuration of the glabella, which, as contrasted with that in *Phillipsia*, is always differentiated in:

1) a more or less gibbous, anterior portion, which may be triangular, pyriform or elongately rounded in form. The differences in the glabellar outline being excellent specific characters.
2) distinctly separated basal lobes. (It will afterwards be discussed, if the interpretation of the lobes, at the base of the glabella in *Griffithides* PORTLOCK, as basal lobes, is sufficiently founded).

Yet there are differences in the character of the separation of those basal lobes and in the general configuration of the anterior gibbous portion of the glabella, as well as in the development of the glabellar and cervical furrows. Among the species, described by PORTLOCK we could, for instance, distinguish between two clearly defined types:

1°. In the longiceps-type (fig. 12), the basal furrows are not curved, but gradually constricting towards the back. They extend to the neck-furrow, thus separating a more elongately rounded triangular anterior portion of the glabella. The se-

paration of the basal lobes is complete. *Griffithides longispinus* is doubtessly also suggestive for this type of glabellar development.

2°. In the g l o b i c e p s-t y p e (fig. 13) the basal furrows are curved, although strongly marked and broad. They do not always extend to the neckfurrow and the separation of the basal lobes is therefore often incomplete, since the latter seem still to be attached to the anterior portion of the glabella by their posterior-interior edge. The frontal portion of the glabella is tumid and almost globular, highly elevated above the cheeks.

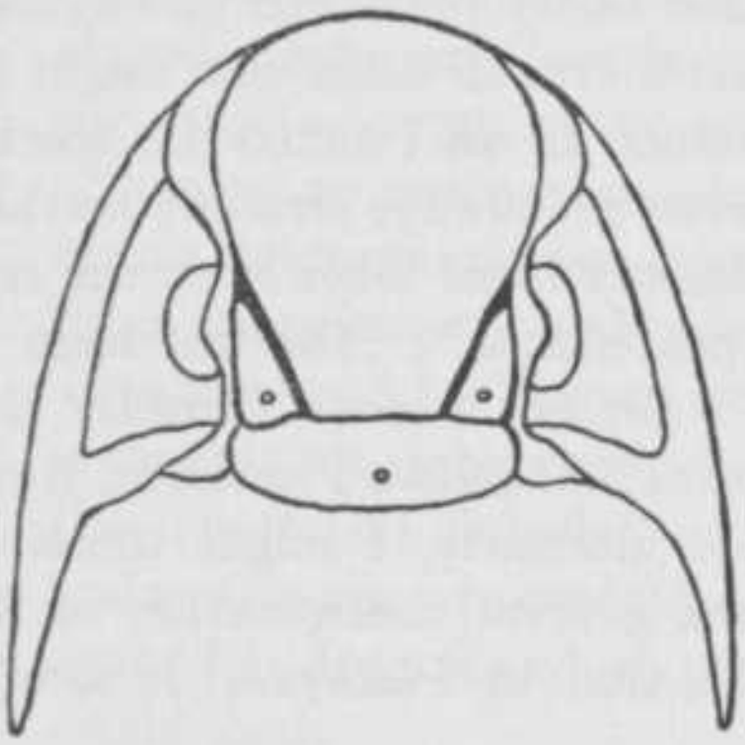


Fig. 12. *Griffithides longiceps* PORTLOCK.

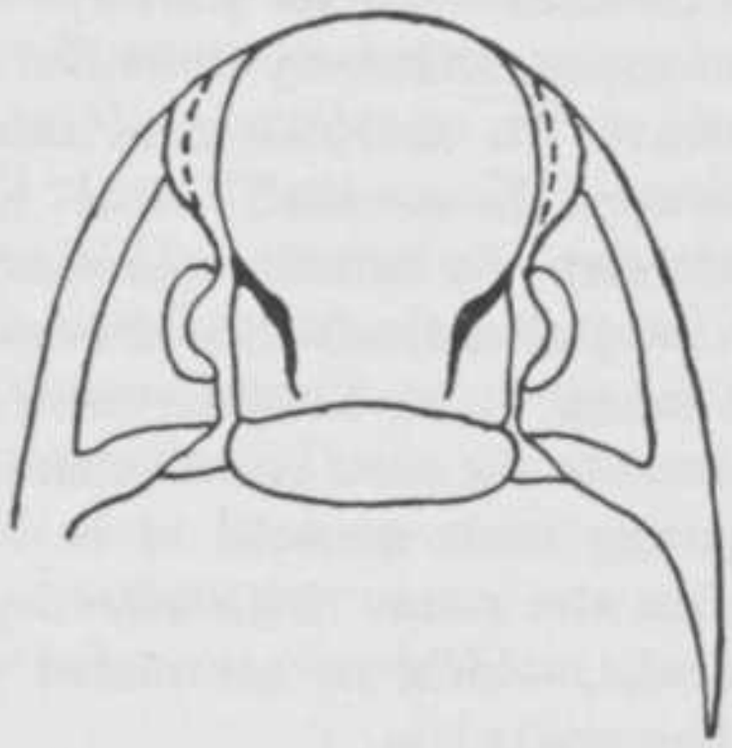


Fig. 13. *Griffithides globiceps* PHILLIPS

WELLER (1936) rightly observed the differences between those two types and restricted the genus *Griffithides* PORTLOCK to accomodate the species, representative for the longiceps-type, leaving it to future investigators to found another new genus upon the base of the globiceps-glabella. Although the discrimination of a longiceps- and a globiceps-genus might be justified by several observations on a great number of permo-carboniferous trilobite-species, I believe it wholly premature to establsih such generic contradistinctious, mainly because:

1) we would then consequently be compelled to create s e v e r a l new genera upon the base of different other glabellar types, easily recognised, as we will see, among the species hitherto described. This would finally lead to the foundation of numerous m o n o t y p i c genera of doubtful independence.
2) the evident and clearly defined m o r p h o l o g i c a l differences between the different glabellar types might as well be

expressed by the establishment of several g r o u p s, each founded upon a typically developed glabella.

3) our knowledge of those trilobites is by far too incomplete to explain the numerous exceptional species, which would not fit in with such an unnatural classification. Compare, for instance, *Griffithides shunnerensis* KING and especially *Griffithides indicus* TESCH and *Griffithides verrucosus* GEMM, which seem so closely related that their complete identification was considered by TESCH. In the descriptive part of this work, it will however be seen that *Griffithides indicus* TESCH undoubtedly has a glabella of the globiceps-type, while in *Griffithides verrucosus* GEMM, there are several features rapproaching this species to the longiceps-type.

4) Little can moreover be said about correlated particularities in the segmentation of the pygidium, since PORTLOCK's statements are very incomplete in this connection and subsequent descriptions make it highly probable that the number of pygidial segments has nearly the same range in both types.

Resuming those remarks, it appears that PORTLOCK's discriminations between *Phillipsia* and *Griffithides* were sufficiently founded and that *Griffithides* has effectively to be considered as an independent genus (cf. WEBER 1933), although its generic status was exclusively established upon the morphological peculiarities of the cephalic shield. WOODWARD's revision (1883) changed completely this point of view, since he involved several new characters in the generic contradistinctions. As such he introduced, among others:

1°. t h e f i x e d n u m b e r o f s e g m e n t s i n t h e p y g i d i a l a x i s, accorded to each of the two genera: from 12 to 18 in *Phillipsia* and a b o u t 13 in *Griffithides*; while PORTLOCK expressively remarked that this number was not to be relied upon in generic discriminations. It can easily be shown that the number of axial segments in the pygidium can never be considered as a conclusive peculiarity in none of the permocarboniferous trilobite-genera, except perhaps in that part of the subgenus *Pseudophillipsia* GEMM, wherein an extremely large number of axial segments in the pygidium (up to 30) seems to be steadily correlated with a typically developped glabella and even there the rapproachment to *Anisopyge* GIRTY and *Ditomopyge* NEWELL (= *Cyphinium* WEBER) clearly de-

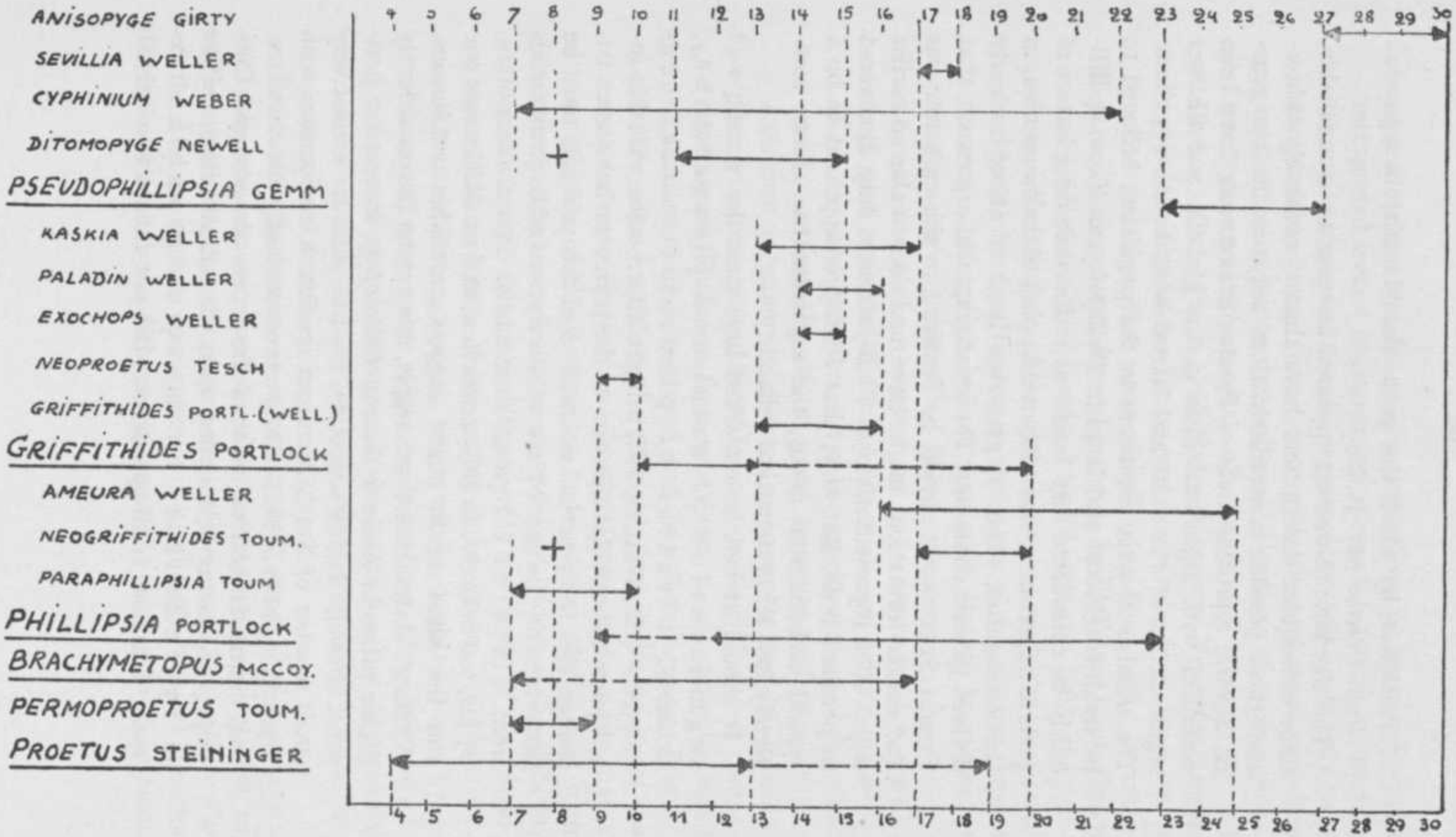
monstrates the questionable systematical value of the number of pygidial segments. This may also be deduced from Table I on p. 37, wherein has been figured the number of axial segments in the pygidium of the different permo-carboniferous trilobite-genera, according to the diagnoses of TESCH, TOUMANSKY, VODGES, WEBER and WELLER (full lines) and completed with corrections of the author, based upon a revision of earlier palaeontological specific descriptions (dotted lines).

From those palaeontological descriptions, it moreover appears that for each genus, the number of pygidial segments, at first strictly limited, increased continually by every new description, so as to range nowadays, very parallelly, (at least in the earlier established genera) between a small (about 7) and a large number (about 25) of axial segments. This experience should have pressed for prudence in several new generic discriminations, as it probably would have prevented the foundation of the genus ***Paraphillipsia*** **Toumansky** (1935), which is remarkably illustrative in this connection. It has a cephalon typical for *Phillipsia* (compare for instance TOUMANSKY 1935 plate III fig. 6) and a pygidium typical for *Proetus*. Since the pygidial features are evidently of less value in generic discriminations (cf. WEBER 1933), the suggestion of uniting *Paraphillipsia* TOUM. to *Phillipsia* PORTL. is strongly corroborated by the observation that the respective number of axial segments in both genera is gradually passing into each other (Tab. 1). Where furthermore the opinion expressed in my introduction is especially applicable to *Paraphillipsia* TOUM. I see, in presence of such transitional evidences, no reason to maintain the genus *Paraphillipsia* as an independent one.

It should, in future investigations, also be taken into consideration to examine in how much these conclusions encroach upon the contradistinguishing of the genera *Proetus* STEININGER and *Phillipsia* PORTLOCK. In separating the latter from *Proetus*, PORTLOCK mentioned but two characters as typically discriminating in a generic way:

a) the presence of lateral furrows in the glabella of *Phillipsia*, which, as PORTLOCK expressively remarked, are not present in *Proetus* (cfr. p. 25):

b) the distinct segmentation of the axial and lateral lobes in



Tab. I. Number of axial segments in the pygiduim of the permo-carboniferous trilobite-genera (cf. p. 36).

Phillipsia, by which this genus should further be separated from *Proetus* (cfr. p. 25).

These generic characters appeared however to be unreliable, since subsequent descriptions have almost completely obliterated those possible contradistinctions between the two genera. Several representatives of *Proetus* STEININGER have been described with segmental lines in the glabella and distinct segmentation of the axial and lateral lobes in the pygidium. The number of axial segments in the pygidium, believed to be small in *Proetus* and large in *Phillipsia* can likewise difficultly be considered any longer as a discriminating feature of generic importance, since the overlapping of the two genera, in this connection, (Tab. 1) grew too large to afford a clearly defined generic character. The stratigraphical argument, that *Proetus* STEININGER should be confined to the carboniferous and earlier formations might have had some value in earlier days, when representatives of *Phillipsia* were only discovered in permian beds; but now, that *Phillipsia* appeared to be a typical carboniferous genus, the argument has almost completely lost its systematical reliability.

It should at last be remarked here that the u n e q u a l s e g m e n t a t i o n o f a x i a l a n d p l e u r a l l o b e s, expressed in r a t i o s o f p l e u r a l t o a x i a l s e g m e n t s (cfr. WELLER 1937) might afford some valuable intelligence for the classification of the permo-carboniferous trilobites. But the practical elaboration of this principle must be performed on the base of n e w descriptions of large materials from d i f f e r e n t regions, since earlier data are very often, by far, too defective in this connection, and small faunas of one and the same region might suggest unreliable conclusions. WELLER's statements, for example, concerning the consistently higher ratios in *Ameura* than in *Ditomopyge* for similar horizons, although highly seductive, are but valid for a relatively small number of North-American species. A comparison with WELLER's Table 5 (1937 p. 343) moreover clearly demonstrates, that contradistinctions between the genera *Ameura* and *Ditomopyge* can never be founded upon the related ratios, neither in s y s t e m a t i c a l nor in s t r a t i g r a p h i c a l respect. WELLER, to all appearance, did not intend to establish

such contradistinctions and his conclusions are exclusively to be interpreted from a *phylogenetical* viewpoint. In this connection the ratios of pleural to axial segmentation will doubtessly have considerable importance, when critically and more generally applied to the permo-carboniferous *Proetidae* of other regions.

2°. the destituteness of lateral furrows of the glabella in *Griffithides* PORTLOCK. From such forms as *Griffithides indicus* TESCH and *Griffithides breviceps* n. sp. it appears at first that some glabellar incisions might be interpreted as degenerate lateral furrows. In *Phillipsia sicula* GEMM and *Phillipsia Colei* (described by WOODWARD 1883) the pyriform differentiation of the glabella, which might be considered as typical for *Griffithides*, is accompanied by distinct lateral furrows. I therefore believe that this feature is rather of questionable discriminating value.

3°. the dimensions and the form of the eyes: large and reniform in *Phillipsia*, small and lunate in *Griffithides*. On closer examination of the species revised or described by WOODWARD himself, it seems however evident that this statement is rather ambiguous, as in much true *Phillipsiidae* the eyes are even smaller than in some *Griffithidae*. A comparison among *Phillipsia derbiensis* MART. clearly shows the small dimensions of the latters eyes, and *Griffithides longiceps* PORTL., among others, exhibits the relatively larger dimensions of the eyes in some *Griffithidae*. It must however be said ,that a correlation of the dimensions and position of the eyes with other features (such as the more detailed form of the glabella) might bring valuable intelligence for the study of the phylogenetical evolution of the permo-carboniferous trilobites (cfr. WELLER's investigations); but it can be doubted if any systematical value might be laid, for the moment, upon such correlations, since the latter are but imperfectly known and are moreover very often troubled by puzzling, exceptional forms.

From this discussion, it appears, that none of WOODWARD's emendations can be applied with security in the diagnoses of PORTLOCK and that the genus *Griffithides* was thus sufficiently defined by the general configuration of its glabella. Several remarks have however to be made here with regard to some of the definitions

and denominations, generally used in palaeontological descriptions of this glabella.

1. According to BARRANDE (1852) the "glabella" includes the lateral and basal, segmental lobes of the median, axial part of the trilobite-cephalon. In most of the genera, the basal lobes are continuous with the anterior, frontal portion of the glabella and BARRANDE's definition presents therefore not the slightest difficulty; but in such genera as *Griffithides* and *Pseudophillipsia*, the basal lobes are completely separated from this anterior portion and the term "glabella" is then generally used in a different way. So, for instance, in PORTLOCK's diagnoses, wherein the glabella is stated to be pyriform. This is obviously incorrect, and PORTLOCK's definition must be completed by the circumscription, that the griffithid g l a b e l l a (in the sense of BARRANDE's) is differentiated, by well-marked furrows, in a pyriform frontal lobe and two "basal" lobes, lying at the postero-lateral sides of the latter. (In the discussion of *Neoproetus sinensis* we will see that GRABAU's misinterpretation of the basal lobes was probably caused by this inaccuracy in PORTLOCK's diagnoses). It should thus be understood that the term "p y r i f o r m g l a b e l l a" is used in an other sense than BARRANDE's term "g l a b e l l a".
2. The well-marked furrows, thus dividing the griffithid glabella are generally interpreted as basal furrows; the definition of "b a s a l f u r r o w s" applying in fact to the posterior, backward curving segmental lines (= posterior set of lateral furrows) of the trilobite-glabella. In *Phillipsia sicula* GEMM, the pyriform differentiation of the glabella is however clearly developed, while, at the same time, the basal furrows are likewise distinctly marked. It may therefore be doubted if the strong, backwardly constricting furrows in the griffithid glabella are really true b a s a l furrows. The pyriform outline of the anterior glabellar lobe in *Griffithides* may effectively have been caused by a secondary differentiation of the phillipsid glabella and not necessarily, as it is generally believed, by the backward curving of the basal furrows. This mode of generation would as a matter of fact, better agree with the presence of lateral furrows in some *Griffithidae* and with the form of the glabella in most of the longiceps-representatives (obviously the

most primitive ones!), whose anterior glabellar lobe is laterally bounded by straight furrows, extending from far anteriorly towards the neck-furrow. Such straight development is difficultly to explain by a backward curving of the basal furrows, which are effectively situated in the posterior part of the glabella. It is clear that this supposition also would involve another interpretation for the lobes, lying at the base of the griffithid glabella.

It may however suffice here to point to the possibility of such an evolution and to remark in this connection, that where the terms basal lobes and basal furrows are used in descriptions of *Griffithidae*, these terms should not necessarily be interpreted in the same way as for the basal furrows and basal lobes in *Phillipsia* or related genera.

The new and more general interpretation of PORTLOCK's diagnosis finally involves a discussion of the genera afterwards established and supposed to be independent of *Griffithides* PORTLOCK.

***Neoproetus* Tesch,** considered by its author (1923) as a subgenus of *Proetus* STEININGER was prematurely raised by TOUMANSKY (1935) to the rank of a genus, its subgeneric position being indeed very ambiguous on account of its presumed striking affinities both to *Proetus* s.s. and to *Griffithides* PORTLOCK. Its diagnosis, essentially founded upon a single complete specimen of *Neoproetus indicus* TESCH [1]) from the locality of Bitauni (Timor), had already been slightly widened by admitting the sicilean species *Griffithides verrucosus* GEMM. into the new subgenus under the name of *Neoproetus verrucosus* GEMM (cf. TESCH 1916 p. 610 and 1923 p. 131). A third species was finally brought to *Neoproetus* by GRABAU (1936), who described a specimen of the chinese Maping limestone as *Neoproetus sinensis*.

In the descriptions of both the genotypes of TESCH's *Neoproetus* and in the discussion of *Neoproetus sinensis* GRABAU, it will be clearly shown, not only that *Neoproetus* TESCH, when it really had to be considered as a separate subgenus should better have been rapproached to *Griffithides* rather than to *Proetus*; but besides, that there is no reason to maintain it any longer neither as genus nor as subgenus, it actually having been founded upon a very incomplete

[1]) WEBER's statement (1933 p. 70) that *Neoproetus* Tesch was founded upon a single cephalon is erroneous.

and contradictory description and upon the evident misinterpretation of the diagnosis of *Griffithides* PORTLOCK.

a) *Griffithides indicus* TESCH and *Griffithides verrucosus* GEMM are more completely discussed in the descriptive part of this work. The contradistinctions between *Neoproetus* and *Griffithides* s.s., as given by TESCH are partly incorrect and for another part wholly insufficient to found upon them a separate genus or subgenus. Some of the new morphological pecularities described afterwards might in some respects, be suggestive for the foundation of such a new genus, which, of course, had to be termed *Neoproetus*, but this would necessitate the foundation of at least two genera (one for *Griffithides indicus* TESCH and one for *Griffithides verrucosus* GEMM), each of them including but one representative. The two genotypes in exhibiting transitional peculiarities to several other *Griffithidae* are, however so closely related in their most typical characters, that their complete identification was considered by TESCH.

b) In more than one respect a detailed discussion of *Neoproetus sinensis* GRABAU (1936) is illustrative. This species was erroneously brought to *Neoproetus*, its description being wholly incongruent with TESCH's diagnosis of *Neoproetus*. The specimen in GRABAU (1936 pl. XXXI fig. 8) is crushed; from the convexity of the preserved marginal border of the free cheek, it can be deduced that this convexity is greater than in *Neoproetus indicus* TESCH or *Neoproetus verrucosus* GEMM. The cephalon of *Neoproetus sinensis* GRABAU would have a semi-circular outline, a feature expressively excluded by TESCH from the diagnosis of *Neoproetus*. The posterior border of the cephalic shield is badly preserved. The occipital ring seems to be relatively small and bears apparently no neck-tubercle. In its whole configuration it is completely different from the occipital ring in *Neoproetus indicus* TESCH or *Neoproetus verrucosus* GEMM. The occipital ring is smooth on the edges; but finely pustulose in the centre.

From the fig. 8*a* and 8*d* in GRABAU (1936 pl. XXXI) it could be deduced that the glabella does not reach to the frontal rim and that there is a moderately large pre-glabellar field (WELLER's smooth band). GRABAU did not mention this peculiarity in his text. The specimen has obviously been crushed in a way that nothing can be

said about the overhanging of the glabella. From the position of the marginal border of the free cheek, it seems evident that it has been distorted, so that its normal position might have been completely different.

Although extremely tumid and almost hemispherical in anterior view the prominence of the glabella is wholly different from that in *Neoproetus indicus* TESCH. The most prominent point is situated at about the centre, whereas in *Neoproetus indicus* it is situated far more anteriorly. The anterior lobe of the glabella is pear-shaped, but much longer than wide. In *Neoproetus indicus* TESCH it is more rounded. *Neoproetus sinensis* GRABAU rapproaches to the longiceps-type. *Neoproetus indicus* is doubtessly globiceps.

GRABAU has obviously been mistaken in the interpretation of the lobes in the cephalic shield of *Neoproetus sinensis*. He stated that the glabella was deprived of lobes and interpretated the lobe on each side of the constricted area of the glabella as eye-lobes. It is clear that this interpretation is erroneous. The eyes are never situated in this part of the cephalon. If the related lobes were really eye-lobes, then the strongly constricting furrows, separating those lobes from the glabella would be dorsal furrows and the chinese species would not belong, neither to the closely related *Griffithidae* s.s. nor even to the family of the *Proetidae*, whose dorsal furrows, in their general course, are nearly parallel. I feel convinced that the constricting furrows in *Neoproetus sinensis* are the "basal" furrows of all other *Griffithidae* and that the related lobes are consequently basal lobes. This is moreover wholly in agreement with the lack of information about the eyes in GRABAU's description. The eyes are obviously missing in the chinese specimen. The abnormal position of the movable cheeks also points in this direction and it is highly probable that an important part of the cephalon has been destroyed. Another fact to be remembered: If the related lobes were really eye-lobes, what would then be the course of the facial suture? What it might be, it would appear entirely different from the proetid facial suture.

The ornamentation of the lobes is not conclusive, since the basal lobes, as well as the palpebral lobes exhibit an ornamentation similar to that of the glabella. The form of the lobes in *Neoproetus sinensis* GRABAU is however, in complete agreement with the assumption that they are basal lobes.

The ornamentation of the glabella is also completely different from that in the timorese species. With regard to the misinterpretation of the basal lobes by GRABAU, nothing can be said about the facial suture. It is probable that a mechanical fracture — quite regular, it must be said — has been considered by GRABAU as facial suture (cfr. GRABAU's fig. 8*d*).

The number of thoracic segments, as mentioned by GRABAU, is completely different from that in TESCH's genus (a t l e a s t 10 in *Neoproetus sinensis* GRABAU and 9 in *Neoproetus indicus*) GRABAU's statement regarding the pygidial segmentation is erroneous. He fixed for *Neoproetus sinensis*, as a x i a l segments, a number typical for the l a t e r a l ribs in *Neoproetus indicus*.

For all those reasons, *Neoproetus sinensis* GRABAU can never be compared with *Neoproetus indicus* TESCH. Both belong, in my opinion, to *Griffithides* PORTLOCK, wherein they should however be brought to separate types viz. groups.

Most of WELLER's genera, arbitrarly established, without the foundation of new descriptions can briefly be discussed here. The genus ***Exochops* Weller** was founded upon the base of a single species, *Phillipsia portlocki* MEEK and WORTHEN. In figuring the holotype, WELLER resolved much of the systematical difficulties arisen around this species, as it now appears from WELLER (193 plate 95 fig. 9), that *Phillipsia portlocki* was erroneously brought to *Phillipsia* and doubtessly belongs to *Griffithides*.

The absence of a flat marginal band anterior to the glabella (also characteristical for *Griffithides* PORTLOCK) can not suffice to diagnose a new genus and is moreover very doubtful, since the continuance of the marginal limb over the front of the glabella is clearly exhibited in the holotype.

A comparison among WELLER's diagnoses of the genera *Griffithides* and *Exochops* makes it highly probable that *Phillipsia portlocki* M. and W., could even be reckoned to *Griffithides* PORTLOCK (emend. J. M. WELLER) or to my longiceps-type. According to WELLER's diagnoses, the only differences between the two genera should then consist:

1°. in the configuration of the pygidial axis, which is low and uniformly arched transversely in *Griffithides* and well-elevated and strongly arched transversely in *Exochops*. WELLER's diagnostical contradistinctions upon the base of the number of

pygidial segments is rather ambigious: *Griffithides* being characterized by 13 to 16 axial and 10 to 12 pleural segments, while for *Exochops* these numbers should respectively be 14 to 15 and 10 to 11. The striking similarity in the pygidial segmentation rather proves the close relationship between both genera.

2°. in the fact, that the eyes in *Exochops* are not covered by palpebral lobes. This is indeed a remarkable character, but it can not be used in systematical discriminations, since it has not been proved, that this feature is peculiar to *Exochops*, and its use as a generic character would revolutionize the nomenclature and classification of the permo-carboniferous trilobites.

Exochops WELLER was apparently founded (cfr. WELLER 1936 p. 707) upon the phylogenetical supposition that the eyes migrated from beneath the palpebral lobes and that the new genus should be distinguished, by this migration, from all other genera. Such a conclusion is wholly premature and can not be proved by the observations on a single species. In this connection *Exochops* WELLER is most illustrative for the thesis, formulated in the introduction, that a classification based upon secondary characters must lead to the creation of numerous monotypic genera.

The genus ***Paladin* Weller** (1936 p. 607) was established upon the Lower-Pennsylvanian species *Griffithides morrowensis* MATHER, while WEBER's russian species *Griffithides lutugini*, *Griffithides cervilatus* and *Griffithides transilis* were considered as typical representatives for the new genus. *Griffithides mucronatus* GIRTY and *Proetus granulatus* WETHERBY should furthermore also be reckoned to *Paladin* WELLER.

Paladin is probably the largest of WELLER's genera and undoubtedly includes a relatively large number of closely related species; but its diagnosis was too narrowly based upon morphological features of doubtessly secondary importance and very small constancy, while, as a matter of fact, the only consistent character in all the representatives of this genus, has not sufficiently been defined and emphasized by WELLER, as it probably would have also applied to several species, which do not exhibit the peculiarities, WELLER seemingly considered of higher classificatory value for generic discriminations.

Such characters as the flat marginal band anterior to the glabella

(= marginal limb) and the dimensions of the eyes, both of chief importance in WELLER's classification, commonly show a large variability and are, by far, less constant than the typical form of the glabella and the advanced character of the pygidial flange. But just in those consistent particularities the genus *Paladin* WELLER appears to be but a small part of a much larger group of strikingly transitional forms.

The variability and highly questionable classificatory value of WELLER's generic characters is sufficiently shown by a comparison among his too schematical fig. 1 (WELLER 1937 p. 339) and the figures of WEBER (1933, p. 33, fig. 14; p. 34, fig. 15; p. 36, fig. 18 and especially p. 37, fig. 18 and p. 39–41, figs. 20–21), from which it clearly appears, that with regard to the development of the eyes, highly different forms were arbitrarly brought together and that in most of the species referred to *Paladin*, the eyes are *not* large, as they were supposed to be in the genus *Paladin* WELLER. Compare, for instance, the dimensions and the position of the eyes in:

Griffithides lutugini WEBER and its variety *robusta* WEBER;

Griffithides lutugini WEBER and *Griffithides transilis* WEBER!

and sepecially in *Griffithides transilis* WEBER and its varieties α and β.

The latter are differing to such a degree, that it effectively would have been better to bring those varieties to separate species, the more as they show also striking differences in the development of the basal lobes and in the frontal ending of the glabella.

It may suffice here, briefly to discuss WEBER's species *Griffithides transilis*, considered by WELLER as one of the typical representatives of his genus *Paladin*. *Griffithides transilis* WEBER *var.* α then differs from the specific type in having:

1) a glabella overhanging the border of the limb in front of it (WEBER 1933 p. 79). Considered by its author as a variety of *Griffithides transilis*, the variety α must in WELLER's classification be referred to an other genus than its specific type-form, on account of the absence of a flat marginal band anterior to the glabella, the latter being diagnostically required for the genus *Paladin* WELLER. This was effectively done by WELLER, who brought the varieties α and β to his new genus *Kaskia* (WELLER 1936 p. 708), notwithstand

ing the fact, that large eyes were supposed to be characteristical for *Kaskia* WELLER, while in *Griffithides transilis* var. α and β the eyes seem to be exceedingly small.

2) prominent basal lobes, by which this variety should be rapproached to *Cyphinium kumpani* WEBER. The closeliness to *Cyphinium*, expressively stated by WEBER is highly suggestive for some conclusions afterwards to be formulated in connection with the "shortening" of the griffithid glabella and the corresponding evolutionary tendencies in the permo-carboniferous trilobites.

Although the absence of a flat marginal band anterior to the glabella has, in my opinion, no systematical importance neither in a generic nor in a specific way, and I thus not agree with WELLER in considering *Paladin* and *Kaskia* as separate, independent genera, I nevertheless might consider the varieties α and β as representative for a distinct species, which I propose to term *Griffithides Welleri* n. sp. in honour of the American investigator, who at first emphasized the morphological differences between WEBER's varieties.

Griffithides Welleri n. sp. is then easily distinguished from *Griffithides transilis* WEBER and the latter's closely allied *var.* γ, by the overhanging of the glabella, the small eyes and by the development of prominent basal lobes. The contradistinctions between *Griffithides Welleri* n. sp. *var.* α and *Griffithides Welleri* n. sp. *var.* β, being for the rest, clearly established by WEBER's detailed descriptions.

The divergence of WELLER's interpretation from that given here, is then clearly and sufficiently illustrated in the different generic position of this new species. In WELLER's classification *Griffithides Welleri* n. sp. is referred to *Kaskia* WELLER, while, in my opinion, it doubtessly belongs to the same group of *Griffithidae* as to which are also to be rapproached the representatives of WELLER's genus *Paladin*. This group is characterized by the typical outline of the glabella, which is distinctly bounded by laterally inflexed furrows, so as to exhibit in its general configuration the most ideal pear-shaped form. Strongly expanded anteriorly, the "inflexed" glabella suddenly narrows at about its middle by a gentle inward curvation (inflexion) of the bounding furrows.

The inflexed outline of the glabella is now the only consistent

character of *Paladin* WELLER and is most clearly exhibited in *Griffithides lutiguni* WEBER *var. robusta* WEBER (1933 p. 34 fig. 15) and especially in *Griffithides Welleri* n. sp. *var.* β WEBER (1933 p. 39 fig. 20). The group, characterized by this inflexed glabella may therefore be denominated the w e l l e r i-g r o u p, on account of its being most clearly illustrated by the species of the same name. From this it moreover sufficiently appears that my w e l l e r i-g r o u p is n o t identical with WELLER's genus *Paladin*, as it is much larger than the latter and effectively also includes species, representative for *Kaskia* WELLER. It will afterwards be shown that the inflexed glabella seems to be steadily corrolated with an obviously advanced pygidium, but even when the welleri-group is essentially established upon this correlation, it can never be raised to the rank of an independent genus, since such a genus would soon appear to be but an assemblage of forms, transitional between *Griffithides* s.s. and *Pseudophillipsia* GEMM.

The genus ***Kaskia* Weller** was very arbitrarly established upon the new species *Kaskia chesterensis* S. WELLER and J. M. WELLER from the Upper-Mississipian of Illinois (WELLER 1936 p. 708). The generic independence was already doubted by WELLER himself, where he expressively remarked that the representatives were not clearly distinguishable from the closely related genera *Paladin* and *Ditomopyge*. In fact the glabella of the genotype *Kaskia chesterensis* (WELLER 1936 plate 95 fig. 4*a*) is but slightly different from the typically inflexed glabella of the w e l l e r i-g r o u p, it being more distinctly continued towards the neck-furrow by a short, nearly parallel-sided prolongation. In the following it will be shown, that the form of the glabella, as exhibited in *Griffithides* (= *Kaskia*) *chesterensis* S. and J. M. WELLER, is highly suggestive for a beginning "s h o r t e n i n g" of the griffithid-glabella and must therefore be considered as characteristical for a small series of species, doubtessly transitional between a more primitive group of *Griffithides* s.s. (probably the l o n g i c e p s-g r o u p) and the more advanced w e l l e r i-g r o u p.

In WELLER's interpretation the genus *Kaskia*, although including but a few number of species, is nevertheless an highly heterogeneous one, since such strikingly different species as *Griffithides Welleri* n. sp. *var.* α and *var.* β WEBER and *Griffithides ovoides* WEBER (1933 p. 63 textfig. 31 and pl. III figs. 33–34) were likewise reckoned to it.

From a comparison of the latter with WELLER's genotype *Kaskia chesterensis* it clearly appears, that species with entirely differing glabellar development may exhibit, in the same degree, such features as were considered by WELLER of chief importance in generic discriminations. The ovoid and strongly inflated glabella of *Griffithides ovoides* WEBER is strikingly different from that in all other *Griffithidae* and can not be compared with the glabella in any of the known species, except perhaps with that in *Griffithides gruenewaldti* MOELLER (cfr. WEBER 1933 p. 38). That *Griffithides ovoides* WEBER nevertheless was brought by WELLER to his genus *Kaskia*, upon the base of the absence or obsolete character of the flat marginal band anterior to the glabella, rather proves the highly doubtful systematical use of this feature.

4. The shortened glabella.

***Pseudophillipsia* Gemmellaro** (1892) was founded as a subgenus of *Phillipsia* PORTLOCK, principally upon the following characters:

1) a glabella with anterior transverse furrows, directed obliquely from behind to forward; the posterior transverse furrows strongly marked and joining on the median line (fig. 14*c*)
2) a pygidium consisting of from 25 to 27 coalesced segments.

As genotypes, GEMMELLARO expressively designated *Pseudophillipsia sumatrensis* ROEMER (1880 p. 10, Taf. 3, fig. 7) and *Pseudophillipsia elegans* GEMM. (1892 p. 14, Tav. II fig. 1 a 4), the latter from the permian Fusulina-limestone of the Sosio-Valley near Palermo in Sicily. Anticipating some conclusions afterwards to be formulated, it may be remarked here, that we have to consider *Pseudophillipsia* GEMM as a strongly specialised and advanced subgenus of *Griffithides* PORTLOCK and not, as it was more recently done, as an independent genus (TOUMANSKY 1935 and WELLER 1936), nor as a subgenus of *Phillipsia* PORTLOCK, as it was effectively interpreted by GEMMELLARO (1892) and TESCH (1923).

A new genus ***Anisopyge* Girty** was afterwards (1908) founded upon the guadelupian species *Phillipsia perannulata* SHUM. (GIRTY 1908 p. 506 pl. XVI figs. 14 to 19) (cfr. textfig. 14*e*) and *Anisopyge antiqua* GIRTY (1908 p. 509 pl. XXIV figs. 23 to 26). From GIRTY's descriptions and figures, it appears that this genus was erroneously

distinguished from *Pseudophillipsia* GEMM. and that, according to the law of priority, it must be completely identified with the latter. WEBER (1933 p. 81) effectively identified both genera without further justifications. These may briefly be given here:

1) GIRTY considered as the more important features in generic discrimination:
   a) the low convexity of the cephalon,
   b) the wide border,
   c) the glabella: much enlarged in front and divided by strong marginal furrows
   d) the absence of genal angles (= spines?)

   It must be noted that some of GIRTY's formulations are rather unusual in the trilobite-nomenclature and might induce one in misleading conclusions about the real morphological configuration of the described specimens. GIRTY furthermore remarked that the related characters appear singly in other genera of the *Proetidae*, but not, as he believed, in combination. In its g e n e r a l formulation this statement is rather ambiguous, since the above mentioned combination can easily be observed in several permo-carboniferous trilobite-species, not belonging to *Anisopyge*. As a matter of fact, the characters, as combinated by GIRTY, can not be used for generic discriminations among the proetid trilobites. If they were consequently to be applied, they would cause a much greater confusion in the nomenclature, than that actually existing, since, with the exception of the configuration of the glabella, none of those characters, neither singly, nor in combination, seems to be consistent in a sufficiently large number of species.
2°. GIRTY was evidently prevented from the identification with *Pseudophillipsia* GEMM. by the presumed stronger specialisation of the latter. It does however not appear from his investigations in which of the morphological features this stronger specialisation should be observable.
3°. As a striking resemblance with *Cheiropyge* DIENER, GIRTY mentioned the very u n e q u a l s e g m e n t a t i o n o f t h e a x i a l a n d p l e u r a l l o b e s i n t h e p y g i d i u m of *Anisopyge*. The rapproachment to *Cheiropyge* is rather surprising, since the closeliness to the other members of the proetid-family, at least in this connection, is by far more evident

than to *Cheiropyge* DIENER, and was already mentioned by PORTLOCK (1843) in his contradistinctions between *Phillipsia* and *Proetus*. But, as a matter of fact, it is just in this morphological peculiarity that *Anisopyge* shows the closest resemblance to *Pseudophillipsia* GEMM. The development of a smooth band along the edges of the axis is a character, which is quite common in permo-carboniferous trilobites and almost general, as I believe, in the younger representatives. The great number of axial segments and their indepence of the lateral segmentation are indeed, also in my opinion, important characters but they are completely identical in *Pseudophillipsia* GEMM.

For all those reasons, I wholly agree with WEBER, that *Anisopyge* GIRTY should be identified with *Pseudophillipsia* GEMMELLARO. The differences in the development of the glabella (compare, for instance, fig. 14*c* and 14*e*) may be considered, at least for the moment, as specific characters and must probably be interpreted, for the greater part, as degenerative differentiations of the griffithid-glabella, since the subgenus *Pseudophillipsia*, doubtessly derived from *Griffithides* s.s., appears to be so heterogeneous, that a systematical classification, arbitrarly and exclusively, based upon the morphological configuration of the glabella must necessarily lead to the foundation of a large number of monotypic genera.

In 1933 WEBER published the results of his investigations on more than 1000 trilobite-specimens, discovered in the permo-carboniferous Donetz-Bassin of Russia, and gave on that occasion the best classification of the proetid trilobites, hitherto established. In this classification a new subgenus ***Cyphinium* Weber,** based upon the subgenerotype *Griffithides scitulus* MEEK and WORTHEN, was separated from *Griffithides* PORTLOCK and rapproached to *Pseudophillipsia* GEMM. As it however appeared from WELLER's investigations on the ontogenic development of *Ditomopyge lansingensis* NEWELL (1931), that the two years earlier established genus ***Ditomopyge* Newell** had effectively been founded upon immature pygidia of *Griffithides scitulus* MEEK and WORTHEN, WEBER's subgenus *Cyphinium* was shown to be a synonym of *Ditomopyge* NEWELL, the latter being redefined by WELLER (1935) on the basis of its mature development. (cfr. WELLER 1935, 1936, and WANG 1937).

According to WEBER's diagnosis, *Ditomopyge* NEWELL (= *Cyphinium* WEBER) is principally characterized by:

1) a glabella, which is supposed to be "shortened" on account of its not abuting against the neckring, from which it is se-

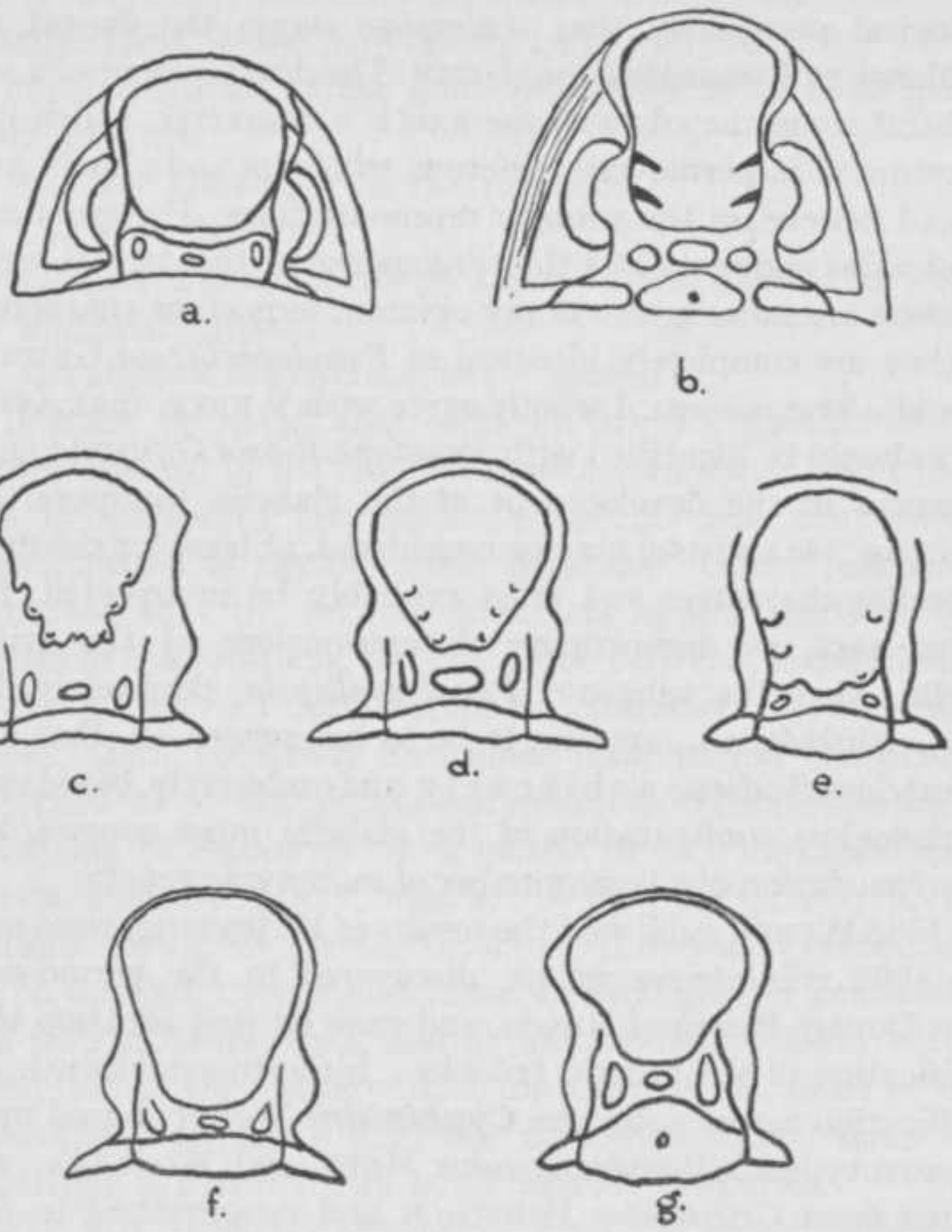


FIG. 14. Types of permo-carboniferous trilobites with „shortened" glabella.

a. Proetus (*Permoproetus*) *postcarbonarius* GEMM.
b. Phillipsia (*Neophillipsia*) *decurtata* n. sp (enlarged × 4)
c. Griffithides (*Pseudophillipsia*) *elegans* GEMM.
d. Griffithides (*Pseudophillipsia*) *obtusicauda* KAYSER.
e. Griffithides (*Pseudophillipsia*) *perannulata* SHUMARD.
f. Griffithides (*Pseudophillipsia*) *kumpani* WEBER.
g. Griffithides (*Pseudophillipsia*) *scitula* MEEK and WORTHEN.

parated by an interval wide enough to include both the basal lobes, torn off from the body of the glabella, and a transverse

lobe lying between them. The median, transverse lobe was termed the "praeoccipital" lobe and was said to be dissimilar to the "anneau occipital" in *Phacops*;

2) the absence of transverse furrows in the glabella.

Pseudophillipsia GEMM., likewise characterized by a shortened glabella, as defined by WEBER, was retained for forms with a strongly scalloped posterior border of the glabella and an extremely large number of axial segments in the pygidium (up to 30).

Several objections have however to be formulated here against WEBER's contradistinctions between *Ditomopyge* NEWELL and *Pseudophillipsia* GEMM.:

a. the transverse furrows in the glabella of *Pseudophillipsia* should not be compared, as it is generally done, with the lateral furrows in the glabella of other trilobite-genera (especially in that of *Phillipsia* PORTLOCK). In the latter, the glabellar furrows are essentially traces of cephalic segmentation and are, as such, always extending obliquely, in backward direction, from the lateral sides of the glabella towards its central part. The posterior set of lateral furrows, the basal furrows, are even strongly curving from the dorsal furrows towards the middle of the neck-region. In *Pseudophillipsia*, on the contrary, the transverse furrows extend obliquely from behind to forward, so as to join on the median line of the glabella. I therefore feel convinced, that the scalloping of the glabella in *Pseudophillipsia* GEMM. has nothing to do with the residual segmentation of the glabella. This supposition seems remarkably corroborated by the phylogenetical evolution of *Pseudophillipsia*, doublessly derived as we will see, from *Griffithides* s.s.

1. Having almost completely disappeared in *Griffithides*, the lateral furrows should at once reappear in the youngest descendents. The law of the irreversibility (cfr. DOLLO) is decidedly opposed to such an evolution;

2. Such transitional forms as WEBER's *Ditomopyge artinskiense* (WEBER 1933 p. 89), doubtessly older than *Pseudophillipsia*, are highly suggestive for the supposition, that the true scalloped pseudophillipsid-glabella developed from a more primitive griffithid-glabella, destitute of lateral furrows. The slight transverse furcation of the posterior border of the glabella in *Ditomopyge artinskiense* was considered by

WEBER as a "vestige" of scalloping. In my opinion, it has rather the character of a rudimentary "beginning", and the scalloping itself should be interpreted as a decay of the griffithid glabella, a degenerative phenomenon reaching its sharpest development in the strongly indented glabella of *Pseudophillipsia* GEMM. It is in this connection highly remarkable that the suggested progressive scalloping is intimately correlated with a parallelly increasing of the number of axial segments in the pygidium and a more and more distinctly differentiated pygidial flange, both tendencies generally recognized as of evolutive significance.

b. The presumed smaller number of axial segments in *Ditomopyge* NEWELL (from 7 to 22) and the larger one in *Pseudophillipsia* (from 23 to 30) are of doubtful classificatory value, since they are so gradually passing into each other, that it would seem rather artificial to base upon them generic viz. subgeneric discriminations, the more as strikingly transitional species have often been described (cfr. WEBER 1933 p. 83).

c. The correlated characters diagnostically required by WEBER for his subgenus *Cyphinium* are not consistently exhibited by the species he considered as representative for this subgenus. *Cyphinium artinskiense* was already mentioned (WEBER 1933 p. 89) as having a posterior glabellar border, which shows remarkably indications of scalloping, a feature proper to *Pseudophillipsia*. *Cyphinium kumpani* WEBER var. *planiloba* WEBER (1933 p. 53 fig. 26) has a frontal border widely projecting in front of the glabella, another character typical for *Pseudophillipsia*. Such aberrant peculiarities are very conclusive and prove the close relationship between the two subgenera WEBER considered, too prudentically in my opinion, as independent ones.

I therefore feel entitled to characterize the subgenus *Pseudophillipsia* GEMMELLARO by its shortened griffithid glabella and to identify with it *Ditomopyge* NEWELL (= *Cyphinium* WEBER), the more as this identification is but a larger emendation of GEMMELLARO's diagnosis, according to the modern standard established in WEBER's clearly defined "shortened glabella". From a systematical viewpoint, the uniting of *Pseudophillipsia* GEMM. and *Ditomopyge* NEWELL is moreover also suggested by the foundation of the equivalent subgenera *Proetus* (*Permoproetus*) TOYMANSKY and

Phillipsia (*Neophillipsia*) n o v. s u b g. both essentially based upon the shortening of the p r o e t i d viz. p h i l l i p s i d glabella.

***Proetus (Permoproetus)* Toumansky** (1935). A puzzling exception among permo-carboniferous trilobites has been for a long time *Proetus postcarbonarius* Gemm. (1892 Tav. I fig. 7) (cfr. fig. 14*a*). This species exhibits a glabella which seems to be slightly shortened and which, at first sight, could be rapproached to that of some representatives of *Ditomopyge* Newell. The small border anterior to the glabella, the destituteness of transverse furrows of this glabella and the small number of axial segments in the pygidium are all features supposed to be typical for *Ditomopyge*. Yet there is a remarkable difference in the development of the lobes at the base of the glabella. These lobes (two postero-lateral ones, elongated in the length-direction of the body, and one median, transverse to the former) are wholly identical, both in form and mutual distances, with those in *Pseudophillipsia* Gemm.; but they are situated o n t h e n e c k-r i n g and not in t h e c e r v i c a l f u r r o w, as is characteristiscal for forms with shortened glabella.

As these features were more recently also observed in the Crimean species, Toymansky (1935) united in the new genus *Permoproetus*, we must admit, that it rather constitutes a general phenomenon and not a local particularity, as could be exhibited by such a narrowly confined, "miniature-fauna", like that of the Sicilean Fusulina-limestone.

There can be no doubt about the absolute morphological similarity of the lobes in *Permoproetus* and those in *Pseudophillipsia*, but their different localisation (o c c i p i t a l in *Permoproetus* and p r a e-o c c i p i t a l in *Pseudophillipsia*) is not easy for explanation.

If the postero-lateral lobes on the neckring of *Permoproetus* are really to be interpreted as basal lobes torn off from the body of the glabella, and the median, transverse lobe lying between them is really identical with Weber's p r a e o c c i p i t a l lobe, then their different position should be explained by an evolutive migration of those lobes from the glabella towards the neckring. Such an evolutionary supposition would however involve several phylogenetical conclusions highly contradictory with the stratigraphical distribution of the permo-carboniferous trilobites.

I therefore agree with Gemmellaro (1892), that *Proetus postcarbonarius* Gemm. and consequently also *Permoproetus* Toumansky

(1935) should rather be rapproached to *Proetus* STEININGER. The primitive, proetid glabella and the small number of segments in the pygidial axis are highly suggestive for this rapproachment. The development of the differently localised cervical lobes might than be explained by a shortening of the p r o e t i d glabella, similar to that of the g r i f f i t h i d glabella in *Pseudophillipsia*. In the systematical classification of the *Proetidae*, *Permoproetus* TOUMANSKY must then have a subgeneric rank equivalent to that of *Griffithides* (*Pseudophillipsia*) GEMM. This supposition is conclusively corroborated by the fact, that an analogous shortening of the p h i l l i p s i d glabella can also be observed in several species hitherto brought to *Ditomopyge* NEWELL, *Sevillia* WELLER or *Pseudophillipsia* GEMM., for which I thus consequently have to establsh a new subgenus, equivalent to *Proetus* (*Permoproetus*) TOUMANSKY and *Griffithides* (*Pseudophillipsia*) GEMM.

***Phillipsia (Neophillipsia)* Nov. Subg.** The new subgenus is based on a well-preserved complete, enrolled specimen from the Pennsylvanian of Kansas (U.S.A.). This specimen was found in the collections of the Geological Institute of Amsterdam and will, on another opportunity, be more detailately described and imaged as *Phillipsia* (*Neophillipsia*) *decurtata* n. sp. (cfr. fig. 14*b*). A provisionally description of its specific pecularities may however briefly be given here:

C e p h a l o n rounded triangular in outline; provided by a moderately well-differentiated marginal limb, which is but partly to be viewed from above on account of its being folded under the border. The limb is longitudinally striated and was probably produced into short genal spines. The convexity of the marginal border of the movable checks is very low. The g l a b e l l a anteriorly extending very near to the frontal rim, without overhanging the latter, is l a t e r a l l y b o u n d e d b y s i n u a t e f u r r o w s; expanded in front, where it is slightly wider than between the eyes; moderately inflated. Two pairs of lateral furrows are faintly discernible. Backwardly the glabella is distinctly s h o r t e n e d; a wide interspace being exhibited between its posterior border and the occipital ring. In this interval a relatively large praeoccipital lobe is developed between two smaller postero-lateral lobes. The e y e s are comparatviely large.

The thorax consists of 9 free segments. The pygidium is triangular in form, distinctly angular in its posterior portion; provided by a smooth marginal limb, which is clearly differentiated from the pleural lobe by the deficiency of segmentation. No marginal furrow discernible. The axis moderately elevated and apically rounded; not reaching to the caudal end of the pygidium. It is composed of 15 coalesced segments, separated by well-marked furrows. The pleural lobes are narrow and composed of 7 broad ribs, separated by relative broad, shallow furrows, which are not continued upon the marginal limb.

The described specimen doubtessly belongs to *Phillipsia* PORTLOCK and is considered as the subgenerotype of a new subgenus, since it clearly exhibits a shortened glabella. At first sight, *Neophillipsia decurtata* n. sp. might be rapproached to *Phillipsia trinucleata* HERRICK (cfr. VODGES 1887 Plate II fig. 9), from which it differs however in several important characters. The glabella reaches far more anteriorly and is more distinctly narrowed at about its middle. The posterior border of the cephalic shield is not curved as in HERRICK's specimen. The number of axial and pleural segments in the pygidium is much smaller than in *Phillipsia trinucleata* and the pygidial flange is less good differentiated. These differences are however — at highest — of specific importance and *Phillipsia trinucleata* HERRICK (1887), likewise characterized by a shortened phillipsid glabella (laterally bounded by sinuate furrows) and well-developed cervical lobes must therefore be considered as a typical representative of the new subgenus.

It should finally be remarked here, that the rapproachment of *Neophillipsia* to *Phillipsia* PORTLOCK, essentially founded upon the sinuate character of the glabella, is conclusively corroborated by the fact, hat true lateral furrows are distinctly exhibited in the glabella of *Neophillipsia*, a peculiarity proper to *Phillipsia* and unknown in *Permoproetus* or *Pseudophillipsia*.

Phillipsia trinucleata HERRICK was therefore erroneously brought by WELLER to his genus *Sevillia*, whose genotype *Sevillia sevillensis* (WELLER plate 95 fig. 1*a*), characterized by transverse furrows in its strongly scalloped glabella, is a typical representative of *Pseudophillipsia* GEMMELLARO, as redefined here.

5. Classification of the permocarboniferous Trilobites.

From the foregoing discussions, it appears that there are but few consistent morphological characters, upon which a classification of the permo-carboniferous trilobites can base. The systematical classification resulting from the revision of the youngest genera of the *Proetidae* may then be resumed as follows:

1. Genus: *Brachymetopus* MacCoy, (1847).

The subgenera *Brachymetopina* Reed and *Brachymetopus* s.s. can not be maintained, while nearer information should be awaited for the identification of *Brachymetopus* MacCoy and *Cheiropyge* Diener

2. Genus: *Proetus* Steininger (1831).

Subgenus *Permoproetus* Toumansky (1935), characterized by a median (occipital) and two postero-lateral cervical lobes.

3. Genus: *Phillipsia* Portlock (1843) defined by a "s i n u a t e" glabella and well-marked l a t e r a l furrows.

1. Subgenus *Phillipsia* s.s.: Glabella not "shortened", abuting against the neck-ring;
   a. m a n s u y i-group: forwardly constricting glabella.

   The genus *Ameura* Weller should probably be brought to this group.
   b. g e m m u l i f e r a-group: glabella almost cylindrical.
   c. e i c h w a l d i-group: glabella expanded anteriorly.

   The genus *Neogriffithides* Toum. should be considered as transitional between *Phillipsia* s.s. and *Griffithides* s.s. In this classification it is therefore brought to *Phillipsia s.l.* The genus *Paraphillipsia* Toum. also belongs to *Phillipsia* s. l., wherein it probably might consistute a separate group.
2. Subgenus *Neophillipsia* n o v. s u b g.: Shortened glabella; well-developed p r a e-o c c i p i t a l, median and postero-lateral cervical lobes.

Part of Weller's genus *Sevillia* is referred to *Neophillipsia.*

4. Genus: ***Griffithides*** **Portlock** (1843): Glabella clearly differentiated in an anterior lobe (strongly constricting towards the back) and completely separated basal lobes.
   1. Subgenus *Griffithides* s.s.: Glabella not shortened.
      a. l o n g i c e p s-group: glabella elongated-triangular, mostly rounded in front.

         The genus *Exochops* WELLER probably belongs to this group.

      b. g l o b i c e p s-group: glabella almost hemispherical.

         The genus *Neoproetus* TESCH is referred to this group

      c. w e l l e r i-group: i n f l e x e d glabella often prolonged towards the neck-furrow. WELLER's genera *Kaskia* and *Paladin* are brought to this group.

   2. Subgenus *Pseudophillipsia* GEMMELLARO (1892): Shortened glabella; well-developed p r a e o c c i p i t a l median and postero-lateral cervical lobes.

      The genera *Anisopyge* GIRTY, *Ditomopyge* NEWELL and *Cyphinium* WEBER are identified with *Pseudophillipsia* GEMM. The genotype of *Sevillia* WELLER is also referred to this subgenus.

      In *Pseudophillipsia* GEMMELLARO, different groups might also easily be recognized, but their mutual contradistinctions would rather be premature, at least for the moment, since it is highly probable that the several groups of *Griffithides* s.s. are continuing into *Pseudophillipsia* GEMM. The evolutive development of the welleri-group is highly suggestive in this connection. The evolutionary tendency, for instance, leading from *Griffithides chesterensis* WELLER, over such species as *Griffithides lutugini* WEBER, into *Pseudophillipsia kumpani* WEBER and *Pseudophillipsia scitula* MEEK and WORTHEN (cfr. fig. 14*f* and *g*), clearly shows the progressive shortening of the i n f l e x e d glabella, which is supposed to be characteriscal for the w e l l e r i-group.

III. PALAEONTOLOGICAL DESCRIPTIONS.

The greater part of the specimens here to be described has been discovered among thousands of other fossils, collected, anno 1935, in the surroundings of Besleo, in the southern district of Central Timor and send to the Geological Institute of Amsterdam by the representatives of the Dutch Government on the Isle of Timor. A great debt of gratitude is owed to Prof. Dr. H. A. BROUWER, Director of the Geological Institute of Amsterdam, who had the kindness of setting this magnificent collections at my entire disposal. Another part of the timorese trilobites, described here, was kindly trusted to me by Professor WANNER of Bonn, to whom I feel for several reasons greatly indebted.

Ir. de MAREZ OYENS procured me some permian trilobites from the Fusulina-limestone of Palazzo Adriano in the province Palermo (Sicily). Prof. Dr. UMBGROVE and Dr. P. KRUIZINGA of the Technische Hoogeschool at Delft allowed me the revision of the permian trilobites described by TESCH (1923) and permitted me the investigation of the specimens collected by W. C. KLEIN (1916) in the sumatrese peninsula and summarily described by TESCH (1916). I am under great obligations to them all and feel glad to return thanks for their continuous readiness.

A. Timor.

Although numerous trilobites are continually discovered in the extreme fossiliferous Besleo-beds of South Central Timor, their relative scarcity remains a striking particularity of the timorese permian fauna (cfr. WANNER 1926). The first mention of a timorese trilobite we owe to BEYRICH (1864), who founded his very uncertain and problematical new species *Phillipsia* (?) *parvula* upon 4 fragmental cephalons, discovered by SCHNEIDER in the neighbourhood of Koepang.

In 1881 MARTIN also reported the finding of trilobites in the palaeozoic beds of Timor but gave no further specification. HIRSCHI (1907) brought from his trip to portugese Timor another incomplete pygidium, which was determinated by BOEHM (1907) as *Phillipsia sp.* but which, after TESCH (1923) probably belongs to *Griffithides* (= *Neoproetus*) *indicus* TESCH. This should however be doubted, since incomplete pygidia are also represented in the collections of the Geological Institute of Amsterdam, closely resembling the specimen described by BOEHM and completely differing from the pygidium of *Griffithides indicus*.

More recently WANNER (1913), MOLENGRAAFF (1911, 1914, 1915) and JONKER (1916) discovered successively 35 specimens in the famous localities, known from their expeditions to the island. TESCH (1923) summarily described them as *Neoproetus indicus* TESCH, *Phillipsia sp. ind.* and *Phillipsia* (*Pseudophillipsia*) *sp. aff. obtusicauda* KAYS. Among these, the latter shows a close resemblance to the new species *Griffithides* (*Pseudophillipsia*) *timorensis* and should probably be identified with it.

In other parts of the Dutch East Indian Archipelago but few trilobites have been discovered till now and their palaeontological and stratigraphical descriptions are usually very incomplete and unavailable.

In a conglomerate of the South-Western part of New-Guinea, MARTIN discovered (1911*a*, 1911*b*) several pygidia belonging to *Proetus* or to *Phillipsia*. ROEMER (1880) described *Phillipsia sumatrensis* from presumable upper-carboniferous beds on the West-Coast of Sumatra. This species was brought by FLIEGEL (1901) to *Griffithides* PORTLOCK and the age of the strata in which it had been found was afterwards stated to be permian. *Phillipsia sumatrensis* doubtessly belongs to the subgenus *Pseudophillipsia* and can be considered as one of the most typical representatives of this part of the subgenus, which should be reckoned to the genus *Griffithides*. It has therefore to be termed *Griffithides* (*Pseudophillipsia*) *sumatrensis* ROEM. As such it should be compared with *Griffithides* (*Pseudophillipsia*) *timorensis* n. sp., from which it differs by the stronger segmental ribs in the pygidial pleural lobe and by a slight backwardly swinging of those ribs.

W. C. KLEIN (1916) discovered in the south-eastern part of Atjeh a trilobite fauna, which he presumed to be of devonian age, but

which, in TESCH's opinion (1916), should essentially consist of the two permian species *Griffithides* (= *Neoproetus*) *indicus* TESCH and *Griffithides* (*Pseudophillipsia*) *sp. aff. sumatrensis* ROEM. The permian age of this fauna is however highly questionable, since KLEIN's specimens ,mostly internal casts, (conservated in the Geological Museum of the Technische Hoogeschool at Delft) are very defective and their determination as *Griffithides* (= *Neoproetus*) *indicus* TESCH must be seriously doubted. This statement is corroborated by the remarkable fact, that all KLEIN's specimens could easily be brought to o n e or t w o species, as it was effectively done by TESCH. The striking monotonous homogeneousness of this fauna rather proves for an older age.

Resuming this historical review, only the timorese trilobites seem worthy of nearer consideration. Although the specimens send to us by the representatives of the Dutch Government were collected in the permian Besleo-beds, without nearer indication of their localities and stratigraphical horizons, some general conclusions may be drawn from their palaeontological investigation. As such are principally to be noted:

1°. the m i x e d c h a r a c t e r of the trilobite fauna of the Besleo-beds. Considered as a whole this fauna seems to be composed of:
   a) an older conservative element, represented by such species as *Griffithides baungensis, Griffithides trigonoceps, Griffithides brevicauda, Griffithides teschi* and *Phillipsia hildae,* which in their general configuration, show close resemblances to the carboniferous species of other regions.
   b) an highly differentiated, younger element, represented by strongly specialised species as *Griffithides indicus* TESCH and *Griffithides breviceps* n. sp.

2°. the s t r i k i n g p r e d o m i n a n c e of *Griffithides indicus* TESCH, which might be considered as a valuable index-fossil for those beds.

Although there are but few particularities to rely upon in eventually comparisons with permo-carboniferous trilobites of other regions it can nevertheless be stated, that there is a striking similarity to the trilobite-fauna of Sosio. The close resemblances between *Griffithides indicus* TESCH and *Griffithides verrucosus* GEMM have been emphasized by TESCH and are in complete agreement

with analogous comparisons between other faunistic elements of both regions; but the presence of a conservative older series among the trilobites of the Besleo-beds might corroborate the supposition that this fauna is stratigraphically older than that from the Sosio-limestone, wherein such an older mixture is obviously missing.

The permo-carboniferous trilobite-fauna of Crimea, according to TOUMANSKY of doubtless similar age than the timorese, is likewise characterised by a mixture of older and younger elements (the less specialised crimean forms being represented by such strange forms as *Brachymetopus sp.*; *Proetus sp.*; and by the representatives of TOUMANSKY's genus *Paraphillipsia*. It is however highly remarkable thas this fauna seems effectively to include a larger number of species, which might be compared with sicilean trilobites. The most typical representatives of TOUMANSKY's genera *Neogriffithides* and *Permoproetus* are for instance to be found in the sicilean species *Proetus postcarbonarius* GEMM. and *Phillipsia sicula* GEMM., forms hitherto not discovered in the permian beds of Timor. No reliable conclusion can however be based upon this observation, since the crimean fauna, considered as a whole, presents too much aberrant peculiarities, that it might stratigraphically be compared with those of the mediterranean region.

Phillipsia hildae **n. sp.**

Pl. I fig. 1*a-b*; textf. 15.

The new species is established upon two complete, well-preserved enrolled specimens, from the permian Besleo-beds in the southern district of Central Timor and upon a pygidium from Niipol Soempek in the same district (Coll. Geol. Inst. Amsterdam.)

Dimensions. The three specimens are of equal dimensions.

Length of the cephalon	6.5 mm
Max. width of the cephalon (at the base)	8.5 „
Length of glabella with neck-furrow and occipital ring	5.5 „
Length of glabella	4.3 „
Max. width of glabella (at the base)	3.5 „
Width of glabella (anterior end)	2.5 „
Length of occipital ring	3.8 „
Max. width of occipital ring (about the centre)	1.0 „
Width of marginal limb	1.0 „
Length of faceted eye	3.0 „
Width of the eye	1.0 „
Length of the thorax	9.0 „
Max. width of thoracic axis (anterior end)	3.5 „

Min. width of thoracic axis (posterior end)	3.0	mm
Max. width of thoracic pleural lobe	2.5	„
Length of pygidium	5.5	„
Max. width of pygidium	7.9	„
Length of pygidial axis	4.5	„
Max. width of pygidial axis (anterior end)	2.9	„
Min. width of pygidial axis (posterior end)	1.8	„
Max. width of pygidial pleural lobe	2.5	„

Description. The cephalon is semi-circular in outline; slightly wider than long. The surrounding border is not separated by a marginal furrow, but is distinctly differentiated by an horizontally outward-bending of the free cheek, which is furthermore strongly convex (fig. 15 cs. 1). In the posterior angle of the movable cheek there is however an indication of a beginning marginal furrow. The glabella, subcylindrical in outline, anteriorly rounded; not reaching to the frontal end of the cephalon; laterally bounded by forwardly constricting furrows. These furrows exhibit however a slight curvature inwards, at about the same level of the anterior end of the faceted eye-lappets; The glabella is marked by 2 pairs of lateral furrows, of which the posterior set, the basal furrows, are well-marked and curving backward to surround the triangular basal lobes, disposed at the base of the glabella, but not completely separated from the latter. The facial suture is the typical one of the genus *Phillipsia*. The eyes are very large, reniform and situated near to the glabella. The extremely well-preserved facetal area is anteriorly rounded, and sharply pointed in the posterior portion.

The occipital ring is well-marked and separated from the glabella by the neckfurrow, which curves towards the front, at about its centre, thus causing a widening of the occipital ring at about its middle. On this central larger portion the neck-ring bears a minute rounded tubercle. The neck-furrow is not continuing into the furrow lining the base of the movable cheek; but ends at the facial suture, slightly under the geniculating-point of the furrow, which separates the posterior border of the head-shield from the free cheek. This posterior furrow of the free cheek is well-marked. The genal angles are rounded and not produced into spines.

The surface of the cephalon seems to be smooth, but a very rudimentary pustulation is to be seen under a magnifier. This granulation is somewhat more distinct in the posterior angular portion of the free cheeks and upon the posterior border, surrounding those cheeks. Immediately under the faceted eye-lappet, at the back of the

latter, there is however a small area which is completely smooth. This area probably corresponds to the suboccular groove in other *Proetidae* (cfr. for instance *Griffithides indicus* TESCH).

The thorax is composed of 9 segments. The thoracic axis is

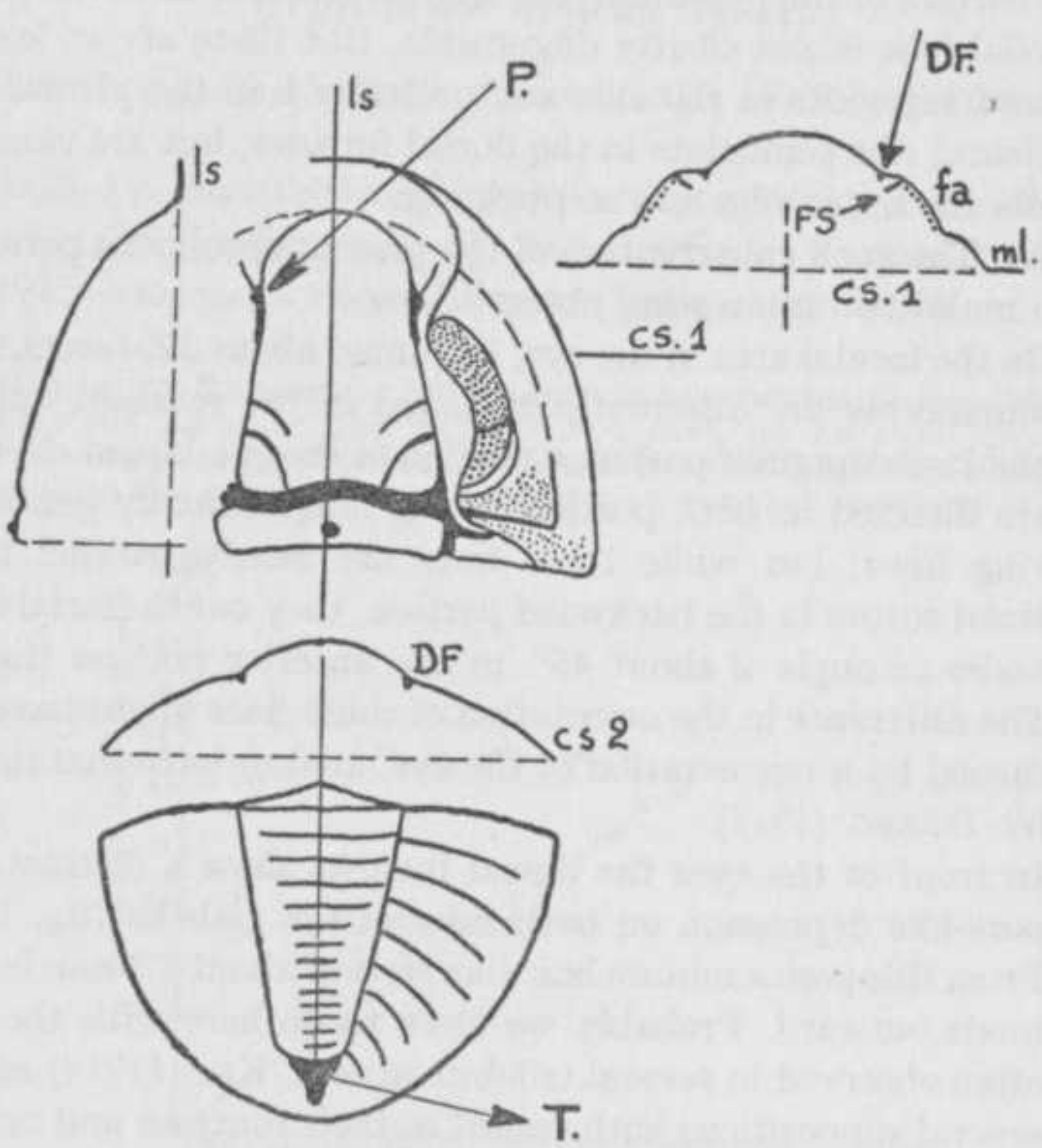


FIG. 15. *Phillipsia hildae n. sp.* enlarged × 5.
ls. longitudinal section trough the cephalon. *cs 1* cross-section trough the cephalon. *cs 2* cross-section trough the pygidium. *DF* dorsal furrow *sog.* suboccular area (smooth). *FS* facial suture. *fa* faceted area. *P* Pore. *ml* marginal limb. *T* telson?

slightly wider than the pleural lobe and decreases moderately in width towards the back. The segments of the pleural lobes are distinctly grooved or furcated on their inward portion.

The pygidium is semi-circular in outline; slightly smaller than the headshield and moderately wider than long; faintly convex (fig. 15 cs 2); without limb; completely smoothed. The axis, feebly convex, is not reaching to the caudal end of the pygidium; but

ends bluntly at about 2 mm of the latter. There is however a remarkable indication of a short spine-like appendix at the posterior end of the pygidial axis. (telson?). The dorsal furrows are moderately constricting towards the back. On account of a certain transparency of the surface of the pygidium, the segmentation of both the pleural and axial lobe is not clearly discernible. But there are at least 14 coalesced segments in the axis and probably 8 in the pleural lobe. The pleural ribs geniculate in the dorsal furrows; but are vanishing towards the outer edge of the pygidium.

OBS. The good conservation of the present specimens permitted me to make two interesting observations:

1°. On the facetal area of the eye, I counted about 320 facets, which remarkably are differently arranged in the rounded anterior, and in the angular posterior portion of the eye-lappet. Yet they are directed in both portions along longitudinally gentle curving lines; but while these lines are nearly parallel to the facial suture in the backward portion, they cut the facial suture under an angle of about 45° in the anterior portion (fig. 15). The difference in the orientation of those lines might have been caused by a regeneration of the eye, analogous to that signaled by ISBERG (1917).

2°. In front of the eyes the dorsal furrows show a distinct, local pore-like depression on both sides of the glabella (fig. 15, P). From this pore a minute hair-like stria of about 1.5 mm long extends outward. Probably we have to do here with the pores often observed in several trilobite-genera. KING (1914) emitted several suppositions with regard to their function and origine.

Affinities. The present specimens doubtessly belong to *Phillipsia* and might be considered as transitional forms between the mansuyi-and the gemmulifera-group, were it not that the glabellar sinus lies far more anteriorly than in other *Phillipsiidae*. In this respect the present species might perhaps be compared to some representatives of *Proetus* (sensu largo). No species has however hitherto been described which might be compared with the present one. In their whole configuration and in the development of their particular features, especially in the gentle indication of segmentation and ornamentation the present individuals make the impression of representing larval stages; but as no transitions of any kind can be shown to mature in-

dividuals I consider them as representatives of an independent new species, for which I propose the name of *hildae* in honour of her, to whom my work is dedicated.

***Griffithides indicus* Tesch.**

Plate I, fig. 2*a-b*; fig. 3; fig. 4; textf. 16, 17, 18 and 19

1923 *Proetus* (*Neoproetus*) *indicus* TESCH 1923 p. 128—132 Taf. 178 (1), fig. 1-*a-c*; fig. 2*a-b*; fig. 3; fig. 4; non fig. 5*a-b*.
1935 *Neoproetus indicus* TESCH (TOUMANSKY 1935).

Preliminary Remarks: This species is represented in my collection by numerous glabellae and pygidia and even by an extremely well-preserved head-shield; besides by a glabella and a pygidium doubtessly belonging to the same individual and by an enrolled specimen of which

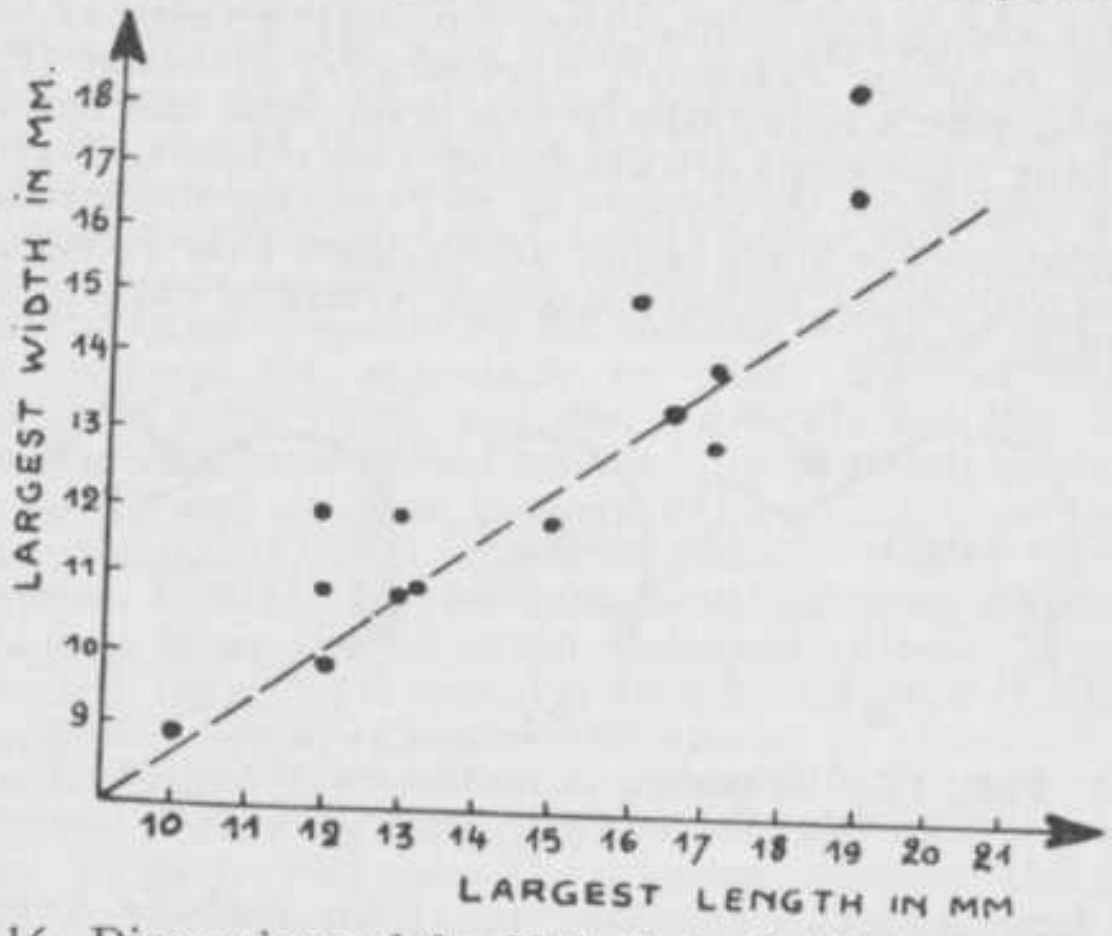


FIG. 16. Dimensions of the Glabella in *Griff. indicus* TESCH.

only part of the cephalon is missing. The thoroughly examination of those specimens as well as the revision of the holo- and paratypes of TESCH's investigations, conservated in the Geological Museum of the Technische Hoogeschool at Delft, need me to make some completing and correcting remarks in addition to the description of dr. TESCH, which, as said above, could be but unsatisfactorily founded upon the single specimen of Bitauni, on account of the few materials and difficult circumstances in which dr. TESCH had to determinate and describe the timorese specimens.

1°. It should at first be stated, that the incomplete diagnosis, as given by TESCH, can only be fully applied to the specimen no. 7 of his collection, which was represented by TESCH's fig. 1*a-c* and has still to be considered as the holotype of *Griffithides indicus* TESCH. It is however highly probable that the incomplete specimens nrs. 4 and 5 of TESCH's collection, represented by his figures 2 and 3, also belong

species, but from an even superficial comparison among TESCH's figures it seems clear, that the form imaged as *Neoproetus indicus* TESCH by fig. 5*a-b*, can never be considered as a true representative of the latter. It clearly shows features wholly different from those, which led TESCH to the foundation of his new subgenus. This specimen is described afterwards as an independent species under the name of *Griffithides baungensis* n. sp.

2°. In TESCH's diagnosis the typical features of *Neoproetus indicus* TESCH are, among others, a strongly elevated "pyriform" glabella, rising above the frontal rim. From my investigation of about 30 glabellae, doubtessly belonging to this species it seems evident, that these features are not so absolute as could be deduced from TESCH's description. They rather show gradually transitions from an extreme form with the features mentioned by TESCH, into forms with very prominent, but apparently more elongated oval glabella. The gibbous, most prominent part of the glabella has however nearly the same proportional dimensions in all the present specimens. The average proportion of the largest length to the largest breadth being 1:1.2; thus giving indeed an almost rounded, spherical and gibbous anterior part of the glabella as the most representative of *Griffithides indicus* TESCH. (fig. 16).

Other transitions evidently show, that the glabella does not always rise above the frontal rim, but may occupy all intermediate positions between extremely overhanging glabellae (fig. 17*a*) and such ones, which lie at nearly one level with the frontal rim (fig. 17*c*). These transitions are gradually and evident, that there is no reason to make any distinction or to found upon them new forms or new varieties. We must rather admit, that this malayan representative of *Griffithides* includes a great variety of but slightly different transitional forms.

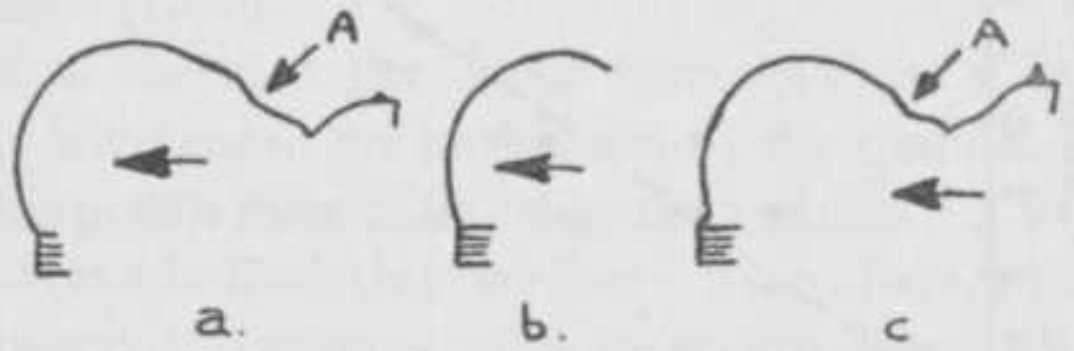


FIG. 17. Transitions in the overhanging of the Glabella of *Griff. indicus* TESCH.

The form and the overhanging of the glabella have both been used by several authors as typically discriminating features. The transitions referred to here, press for prudence in this connection, as they seem to indicate, that we have rather to do with peculiarities of individual importance.

3°. TESCH states (1923 p. 129) that the glabella is transversally wrinkled on the frontal side and is punctated in the neck-furrow. The transverse wrinkling seems to be very regularly concentric and parallel to the contours of the glabella. The punctation is however not limited to the neck-furrow, but proceeds sometimes far on the posterior side and is often very distinct on top of the glabella and on the lateral sides of the anterior gibbous portion of the glabella (fig. 20). It is also to be noted here that the deepest part of the neck-furrow and other furrows is completely smooth and that the ornamentation of these furrows is rather confined to their slopes. The arrangement of the small granules in the punctation is also almost concentric and parallel to the contours of the gibbous portion of the glabella. There

are about 4 pustules in 2 mm, but this number is quite irregular on account of the different dimensions of the pustules and their irregular distances from one another. The transition of the transverse wrinkling to the punctation is often very irregular. I am enclined to consider these transitional differences between different specimens, as a real phenomenon of age, for I often remarked, that the wrinkling tends to rule in the bigger specimens, while in smaller forms the punctation occupies a larger area than the transverse wrinkling, which is limited in those forms to the frontal side of the glabella, everyway under preservation of the parallelism to the frontal border.

4°. In his diagnosis TESCH stated (1923 p. 129) that with the exception of the deep neckfurrow, there are no furrows to be seen on the glabella. He furthermore did not mention the presence of b a s a l l o b e s on the cephalon of *Neoproetus indicus*. In this connection his fig. 5*a-b* are very contradictory to his statements, since they exhibit very prominent basal lobes and consequently also backwardly curving basal furrows, as both features are always intimately connected with one another, for the basal lobes are actually separated from the glabella by the posterior set of backwardly curving lateral furrows, the so-called basal furrows.

Even when it is true that the specimen, imaged as *Neoproetus indicus* TESCH (1923 Taf. 168 (1) fig. 5) does not belong to this species I must firmly contradict the total absence of basal lobes in *Neoproetus indicus* TESCH. As a matter of fact, there exists in this connection a very close resemblance between the timorese *Griffithides indicus* TESCH and the sicilean *Griffithides verrucosus* GEMM, whose basal lobes are hardly prominent — "appena prominenti" — as it was diagnostically stated by GEMMELLARO (1892 p. 12). On account of the larger dimensions and proportions in *Griffithides indicus* TESCH, the basal lobes are by far more easily to be detected than in the sicilean species, especially by their distinct ornamentation, consisting of a very fine and dense granulation (fig. 20), while the separating basal and dorsal furrows are completely smooth.

The broad and shallow, backwardly curving basal furrows, which separate the basal lobes from the glabella should therefore not be confounded with the less distinct dorsal furrows, which separate the basal lobes from the elevated palpebral lobes. TESCH obviously confounded them, as it was also done by GRABAU (1936) in his determination of *Neoproetus sinensis* GRABAU.

In well preserved specimens a remarkable feature is moreover to be observed indicating the probable presence of degenerated lateral furrows. In such specimens the posterior slope of the glabella exhibits a scalariform declivity towards the neck-furrow (fig. 17*a* and *c* in A; fig. 20 dLF), thus differentiating the glabella into a strongly gibbous anterior portion and a small lowered portion just behind it. It is highly probable that the depression causing this differentiation must be interpretated by the degeneration of the anterior pairs of lateral furrows. As a matter of fact a rudimentary and smoothed incision is to be seen there on each side of the glabella.

5°. In connection with the facial suture there is an inaccuracy to be remarked here in the figures of TESCH. In his description of this suture TESCH states that it is "beginning on the posterior border of the cephalon, firstly progressing inward and then suddenly bending towards the eyes. From t h e e y e s i t r u n s p a r a l l e l t o t h e l o n g i t u d i n a l a x i s o f t h e b o d y and finally cuts the frontal rim under the overhanging glabella". This correct description is however misinterpreted in TESCH's figures, where a distinct curvation or expansion of the facial suture is to be seen

between the eye and the frontal rim. The absence of such an expansion is very interesting in *Griffithides indicus*, as it is quite unusual in representatives of the *Proetidae*.

6°. One of the most typical features of *Neoproetus indicus* TESCH should consist, after its author, in the absence of a central node on the neck-ring, but in this connection his already related fig. 5 again contradicts his diagnostical statements, for it exhibits a very distinct neck-tubercle in the midst of the broad and swollen occipital ring.

All the specimens of my collection, even the badly preserved ones, show this central neck-tubercle, which, it must be said, is minute and never reaches the dimensions of the nodes in other tuberculated forms. The most conclusive fact here to be mentioned is the presence of a distinct node on the occipital ring of TESCH's holotype, conservated in the Geological Museum of the Technische Hoogeschool at Delft.

7°. Number of thoracic segments. TESCH stated that the thorax of *Neoproetus indicus* is composed of 8 free segments. This would be a very remarkable exception among the *Griffithidae*. The original specimen of TESCH's collection has however been transversally broken in the midst of the thorax and it is highly probable that the posterior part has been shoven under the anterior one just enough to hide one of the thoracic segments. I therefore firmly believe that the thorax is actually composed of 9 free segments. Out of prudence however I prefer to state diagnostically the presence of 8? or 9 thoracic segments. In support of my statement two arguments can be set forth:

a. the complete specimen of my collection, doubtessly belonging to *Griffithides indicus* TESCH, exhibits 9 thoracic segments;

b. In the sumatrese specimens TESCH (1916) summarily described as *Neoproetus indicus* TESCH, all thoraces are composed of 9 segments.

In the comparison among *Neoproetus indicus* and *Proetus postcarbonarius* GEMM. TESCH used the proportional length of cephalon: thorax: pygidium, as one of the discriminating features. The value of those measurements is however very doubtful, as remarkable differences may occur in the apparent length of the thorax by the differences in the enrollment of different specimens. In *Neoproetus indicus* TESCH the proportional lengths were measured at 3 : 4 : 3. In my complete specimen this proportion would be 3 : 7 : 3. The difference may be explained both by the state of enrollment and by the probability, that a thoracic segment is lacking in TESCH's holotype.

8°. Regarding the configuration of the pygidium the description of dr. TESCH is not less accurate and his figures are even more misleading. The genotype of *Neoproetus* figured in Taf. 137 (1) fig. 1*a-c*, shows no differentiation of the pleural segments towards the outer border and consequently no differently segmented marginal area, while fig. 4 exhibits a distinct and well-differentiated marginal area. On the original of dr. Tesch's fig. 1. I could however observe the presence of a slight but distinct longitudinal depression, running across the segments of the pleural lobes and thus differentiating a distinct marginal zone of about 2 à 3 mm. in width just as it is more accurately imaged in TESCH fig. 4. All the pygidia of my collection exhibit this longitudinal depression (Pl. I fig. 2*b*) with the connected marginal area, where the pleural segmentation vanishes gradually in larger and less differentiated ribs. The marginal border in *Griffithides indicus* is therefore not, as in most representatives of *Griffithides*. an horizontally extended well-differentiated limb but a more indistinctly marked zone where the segmentation vanishes, while the marginal border is curved vertically (Fig. 18*a* M, C) or slightly obliquely downward (Fig. 18*a* D).

9°. TESCH stated that the rachys of the pygidium was composed of 9 coalesced segments and fixed this number as typically discriminating for his subgenus *Neoproetus*. At the same time he included however in this subgenus, *Griffithides verrucosus Gemm*. with 10 axial segments. As a matter of fact, I could observe in both those species the presence of 9 and 10 coalesced segments, without being able to find other discriminating features between specimens exhibiting this different number of axial segments.

10°. Differentiation of the pygidial axis. Correlated with the different behaviour of other characters are important variations in the general configuration of the pygidial axis of *Griffithides indicus* TESCH. It would perhaps be possible to distinguish 2 or 3 varieties among the 30 pygidia investigated here, but as they show all the typical features of *Griffithides indicus* TESCH, I prefer to describe them rather as different individual forms of the same species, between which all transitions may be possible. The finding of more complete specimens will surely bring clearer relations among the seemingly different forms, brought here altogether to *Griffithides indicus* TESCH. For the moment this is however wholly impossible, because with one exception I only dispose of lose pygidia (which are equal both in number and dimensions to the glabellae described above). This great diversity of forms among the pygidia is on the other side fully in agreement with the great number of transitional variations among te glabellae. As a matter of fact the gradually transitions between the various pygidia are much clearer to state than those between the different glabellae and they seem to indicate that we have rather to do with specimens of different age. This was another reason to me not to

distinguish new varieties or new species, which as said above could only have been founded upon lose pygidiae. The pygidia referred to here, doubtestly belong to *Griffithides indicus* TESCH and they all exhibit the typical features mentioned by TESCH (1923 p. 129). They all are semicircular in outline have a strongly elevated axis with 9 coalesced segments (on 2 of those pygidia I counted however 10 axial segments). The axis is nearly reaching to the caudal end of the pygidium. The segments of

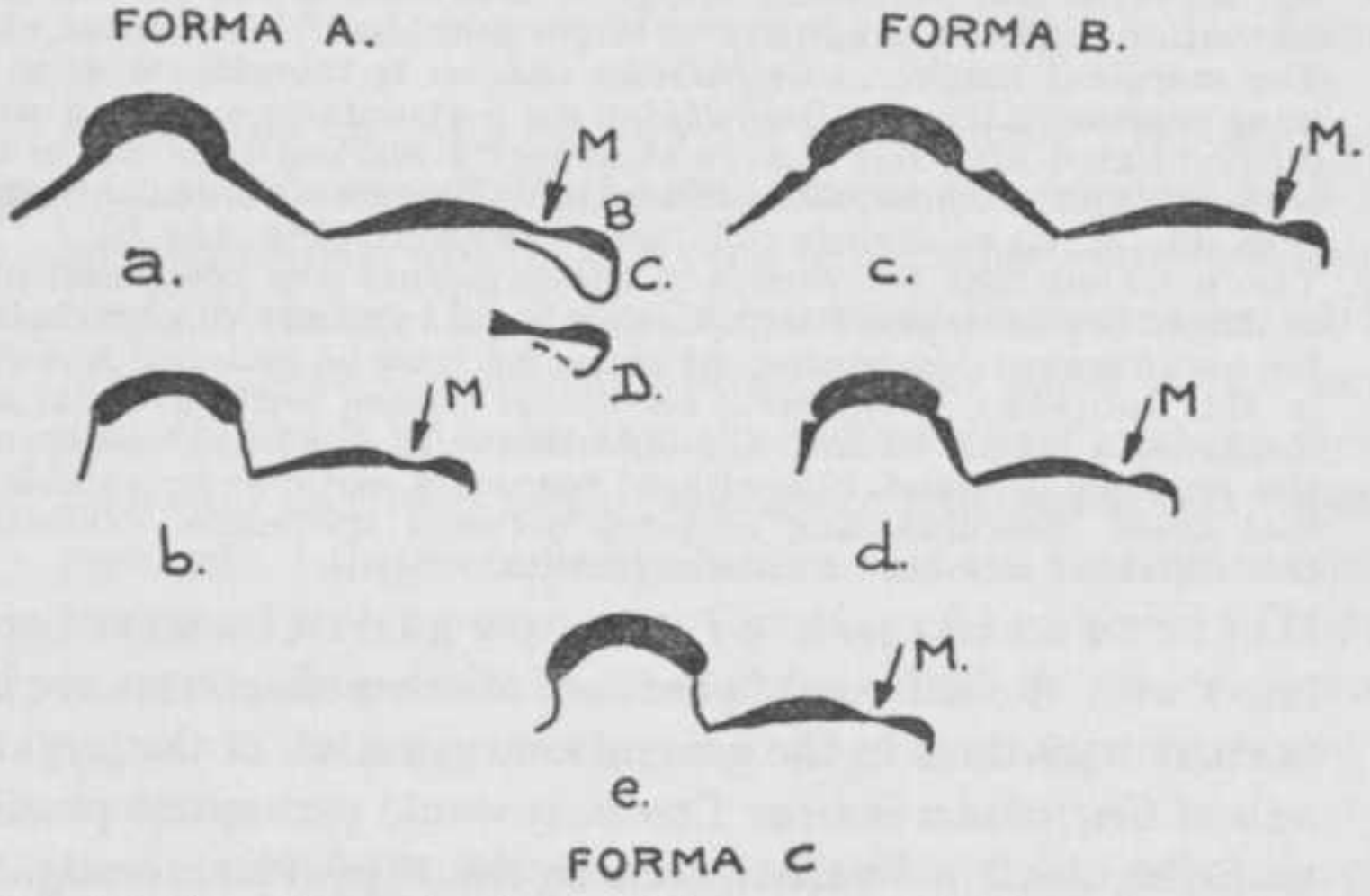


FIG. 18. Transitions in the pygidial axis of *Griff. indicus* TESCH.

the axis as well as these on the pleural lobes are always separated by deep furrows. The number of pleural segments is 6 or 7. The test is always punctated as imaged by TESCH's fig. 2*b*. The marginal rim is always curved, as schematized in fig. 18*a*, and bent downward (rectangularly fig. 18*ac*) or slightly obliquely (fig. 18*a* D) under the pleural lobes). The marginal border is always covered with parallel striae.

The suggested diversity of transitional forms rather consists in differences in the segmentation of the lateral surfaces of the axis and in the different positions taken by those surfaces. In all the present specimens we can easily distinguish a differentiation of the axis in a strongly segmented crest and 2 lateral bands with weaker or very often even undiscernible segmentation (smooth bands).

This differentiation is caused by a slight depression running longitudinally on each side of the axis, on about half-height of the lateral surfaces. The strongly segmented crest is always strongly arched and behaves very alike in all the present specimens. Yet there is often a difference in the behaviour of the related depression, causing, as suggested above, the possible distinction of two, otherwise quite similar forms, connected with one another by gradually transitions.

In the first of them, as represented by TESCH (1923 Taf. 178 (1) fig. 4) the depression lies very regularly at the base of the crest, giving on a section through a segment (fig. 18*a*) and thus strictly limiting the arched and segmented crest against the weaker segmented or smoothed lateral bands. In other cases the depression alluded to, is rather a sharply defined groove cutting the axial segments in their lowerest part on the lateral sides of the rhachys. A section through one of the anterior segments of such a form would give (fig. 18*c*), in which it is clearly discernible, that the lowerest part of the axial segment is cut off by the groove and stands as a remnant little (often pointed) node on the upper side of the lateral area (pl. I fig. 2*b*).

Even when I call the first forma A and the second forma B, this does not mean that I attach any systematical significance to this different behaviour, for one can see each of these forms gradually passing into each other. This point of view is satisfactorily corroborated by the following observations.

The smaller specimens, evidently corresponding to younger individuals exhibit one or other of those features over the whole length of their axis; that is to say, one could make through every segment of the pygidium a section as given in fig. 18*a* or *c*. The only difference in such sections would be that the lateral surfaces of the axis decrease in width and have a more vertical position in the posterior segments (fig. 18*b* and *d*). In the forms with the related remnant nodes of axial segmentation, these nodes decrease at the same time in backward direction (fig. 18*d*) and finally tend to disappear in the caudal segments, so that a section through such a segment would give completely the same scheme as fig. (18*b*).

In the bigger and obvious older individuals, the features described above are confined to the anterior segments of the

axis, while a section through the posterior segments clearly exhibits a very distinct overhanging of the crestal segment over the lateral surface (fig. 18*e*). An older specimen thus demonstrates in its axial segments, from the anterior to the caudal one, all transitions c → d → e or a → b → e, thus confirming the supposition that there really is no reason to make any systematical distinction between those different forms. The biggest specimens exhibit this overhanging crestal segments over the whole length of their pygidial axis and it is very remarkable that in such forms the lateral surfaces of the axis are always completely smoothed. I therefore might consider those forms as the most extreme and term them forma C.

11°. The figures 19*a-b*, at last show the different behaviour of the caudal end of the rhachys, in its relation to the posterior end of the pygidium. In younger forms (fig. 19*a*) the axis does not reach to the end of the pygidium, while in older forms (fig. 19*b*) it lies at nearly one level with the caudal border of the pygidium and may even show a slight overhanging over the latter. This overhanging (Pl. I fig. 4) seems to be closely connected with the differences in the behaviour of the lateral surfaces of the axial lobe.

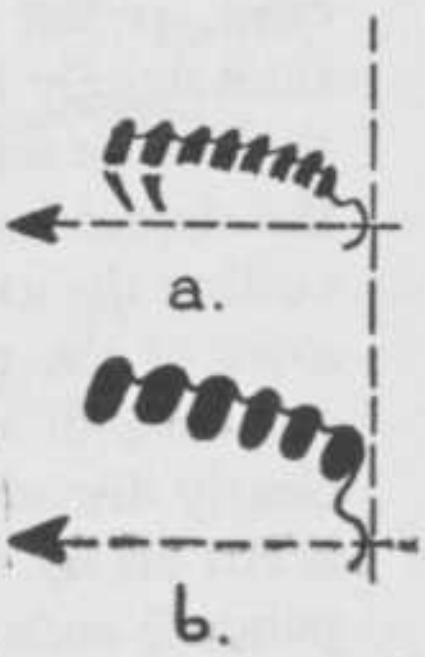


FIG. 19. The caudal end of the pygidial axis in *Griff. indicus* TESCH.

Dimensions: The largest glabella of my collection permits an evaluation of the largest individual hitherto found. The cephalon would have in this specimen a length of 25 mm. The smallest pygiduim is 12 mm in length and 16 mm in breadth. The proportion of largest length to largest width being in all the present specimens of lose pygidia nearly from 3:5 to 3:4. In the complete specimen the proportional lengts of cephalon: thorax: pygidium give the proportional value of 3 : 7 : 3.

Description Resuming the remarks formulated above, we can complete TESCH's description by the following specific summary:

The c e p h a l o n is rounded triangular in outline, provided with a large limb, which is moderately differentiated by a rather indistinct marginal furrow, especially along the posterior border of the movable cheecks, where the limb is however only partly to be viewed from above, on account of its being folded vertically under the test. In the frontal part of the cephalon the limb disappears under the

anterior gibbous portion of the glabella, but is still to be viewed in front. The limb is covered with parallel striae, running slightly obliquely to its longitudinal direction. On the posterior angle of the free cheek this marginal border is probably produced into a short genal spine. The g l a b e l l a is pear-shaped, but differentiated in a strongly prominent, gibbous almost spherical anterior portion and a lowered posterior portion; sometimes anteriorly overhanging the frontal limb or lying at nearly one level with the latter; bounded bij deep, posteriorly constricting furrows; ornamented in front with short transverse and seemingly concentric wrinkles. Towards the neck-furrow and on the lateral sides the transverse wrinkling passes into a dense punctation of small granules. The smoothed backwardly curving basal furrows are broad and shallow. A slight smoothed incision on both sides of the glabella indicates the presence of two degenerate lateral furrows. The b a s a l l o b e s (fig. 20) are hardly prominent, sub-crescentic in form, being rounded towards the interior side; completely separated from the glabella by the basal furrows; lying in the proximity of the eyes, from which they are separated completely by the narrow dorsal furrows; punctated with small granules. The o c c i p i t a l-r i n g is broad and swollen and separated from the glabella by a deep neck-furrow, which curves in its central portion towards the glabella. The neckring is ornamented over its whole surface with small granules, which seem to be larger and more distinct on the posterior margin. A central neck-tubercle is always present in the midst of the most prominent central part of the occipital ring. The f r e e-c h e e k s are strongly convex, triangular in form and covered on their raised portion (the "genal field") with a dense punctation of small granules, except immediately, under the eyes, along a relatively large, bandlike depression ("suboccular groove"), which is completely smooth. They are posteriorly bordered by a strongly erected and well-differentiated, punctated border. The f i x e d c h e e k s are narrow, on account of their limitation by the f a c i a l s u t u r e, which begins on the posterior border of the cephalon, curves inwards and then in a gentle curve outward, around the palpebral lobe and extends from the eye p a r a l l e l t o t h e l o n g i t u d i n a l a x i s o f t h e c e p h a l o n to disappear with a sharp angle under the front end of the glabella. The fixed cheeks are punctated on the raised portion of the very prominent palpebral lobes.

The e y e s are relatively large, their length being somewhat more than $\frac{1}{3}$ the length of the glabella; crescent-shaped; seemingly smoothed on their external surface.

The t h o r a x is composed of 8? or 9 free segments. Rhachys elevated. Pleurae bent rectangularly, indistinctly furcated. Thoracic segments punctated over the whole their surface.

The p y g i d i u m is semi-circular in outline and marginally differentiated in a differently segmented border, which is folding vertically or slightly obliquely under the test. The axis is strongly elevated, somewhat larger in width than the pleural lobe, and but slightly constricting posteriorly. Strongly variable configuration of the axis, which is differentiated in a strongly segmented crest and two lateral bands with weaker segmentation. There is a possible distinction to be made between 3 different forms:

FORMA A: Lateral surfaces of the axis segmented regularly; the lateral surfaces have indistinct segments directed towards the dorsal furrows and towards the back.

FORMA B: The lateral surfaces exhibit distinct segmentation on the upper side, where a moderately prominent often pointed "remnant node" is cut off from the crestal segments by a longitudinally depression. From this point the segments are vanishing towards the dorsal furrows.

FORMA C: Smoothed lateral surfaces on the pygidial axis and overhanging crestal segments.

The a x i a l s e g m e n t s are in number of 9 or 10; well-differentiated and separated by deep furrows on the crest, where they are slightly arched backward and seem often to be reversed posteriorly (fig. 19*a*) except in forma C, where they appear to be rounded at the top. (fig. 19*b*).

The p l e u r a l s e g m e n t s are in number of 6 or 7; well-differentiated by rather deep furrows; sometimes more prominent towards the midst of the pleural lobe, thus accentuating the convexity of this lobe (fig. 18). On the curving of the marginal area the segmentation is vanishing into broader and less distinct ribs. In some cases it might appear as if the margin is not entire but slightly fimbriated on account of the thickening of those ribs on the margin and the being folded of the border. This border is not to be identified with the horizontally extended and well-differentiated limb of most *Griffithidae*.

The whole surface of the test is finely and irregularly punctated in well-preserved specimens.

Affinities and Differences. Although this species has been rapproached to several other ones, it appears from its closer examination that none of the *Griffithidae* hitherto described can be compared with it, except perhaps *Griffithides verrucosus* GEMM. with which, at first sight, it is easily to be confounded. The ornamentation of the test, the configuration of the pygidium, and the remarkably developed marginal border of the pygidium are features wholly identical in the timorese and sicilean species, but there is an essential difference in the morphology of the glabella. In *Griffithides indicus* TESCH, the globular anterior portion of the glabella has a globiceps-character, while the lateral, secondary incisions at the back of this strongly gibbous portion might indicate a transitional shortening of the glabella. The lowered posterior portion between those incisions and the neckfurrow could then be considered as a rudimentary praeoccipital lobe.

In *Griffithides verrucosus* GEMM. the gradually tapering of the glabellar gibbosity towards the back and the regularly backward constricting of the furrows, bounding the glabella rather point to longiceps-peculiarities. The basal lobes however, in being still adherent to the glabella, constitute a particularity unknown, as I believe, in the representatives of the more primitive longiceps-type; anyhow, both the timorese and sicilean specimens are of the highest importance in the study of the permian trilobites. It is namely highly remarkable that *Griffithides indicus* TESCH in being by far the most dominant form in the timorese Besleo-beds and *Griffithides verrucosus* GEMM. likewise the ruling species among the permian trilobites of Sicily, show at the same time such close resemblances in their general configuration and especially in the development of the pygidium, which is rather a striking aberrant one among the *Griffithidae*.

It can therefore not be doubted that both species belong together, as was rightly recognized by TESCH. The essentially differing particularities in the configuration of their glabellae should rather be explained by a degenerative differentiation and specialisation of those youngest trilobites. Such a degeneration may be indicated by the multiple morphological relations they apparently show to v a r i o u s species, doubtessly representative for groups completely

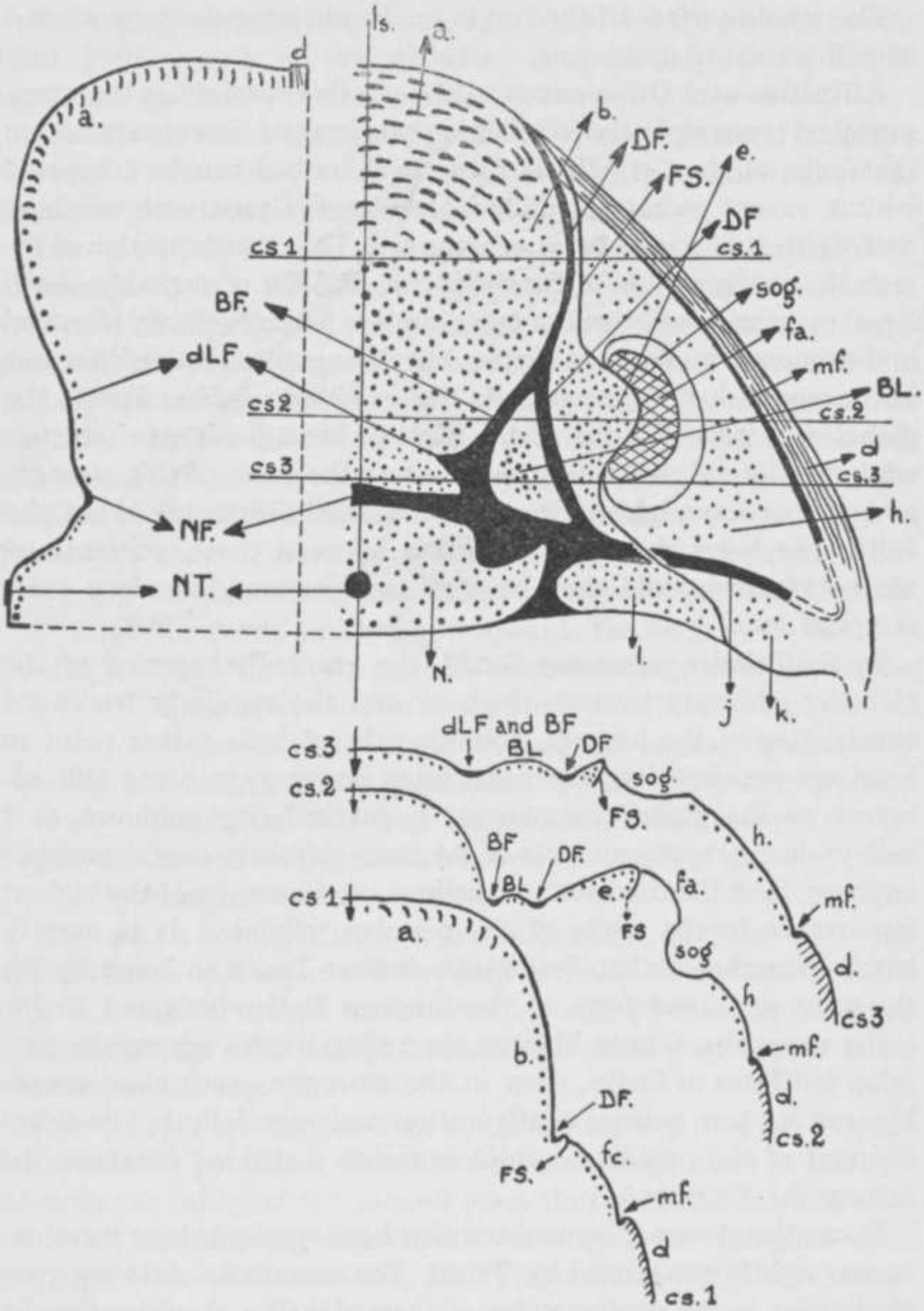


FIG. 20. *Griffithides indicus* TESCH.

Legend to fig. 20 and fig. 21 a. transverse wrinkling; b. punctation of the lateral side of the glabella; BF. Basal furrow; BL. Basal lobe; cs. cross-sections; d. striated marginal rim; DF. dorsal furrow; dLF. degenerate lateral furrow; e. punctated raised portion of the fixed cheek; fa facetal area of the eye; fc. free cheek; FS. facial suture;

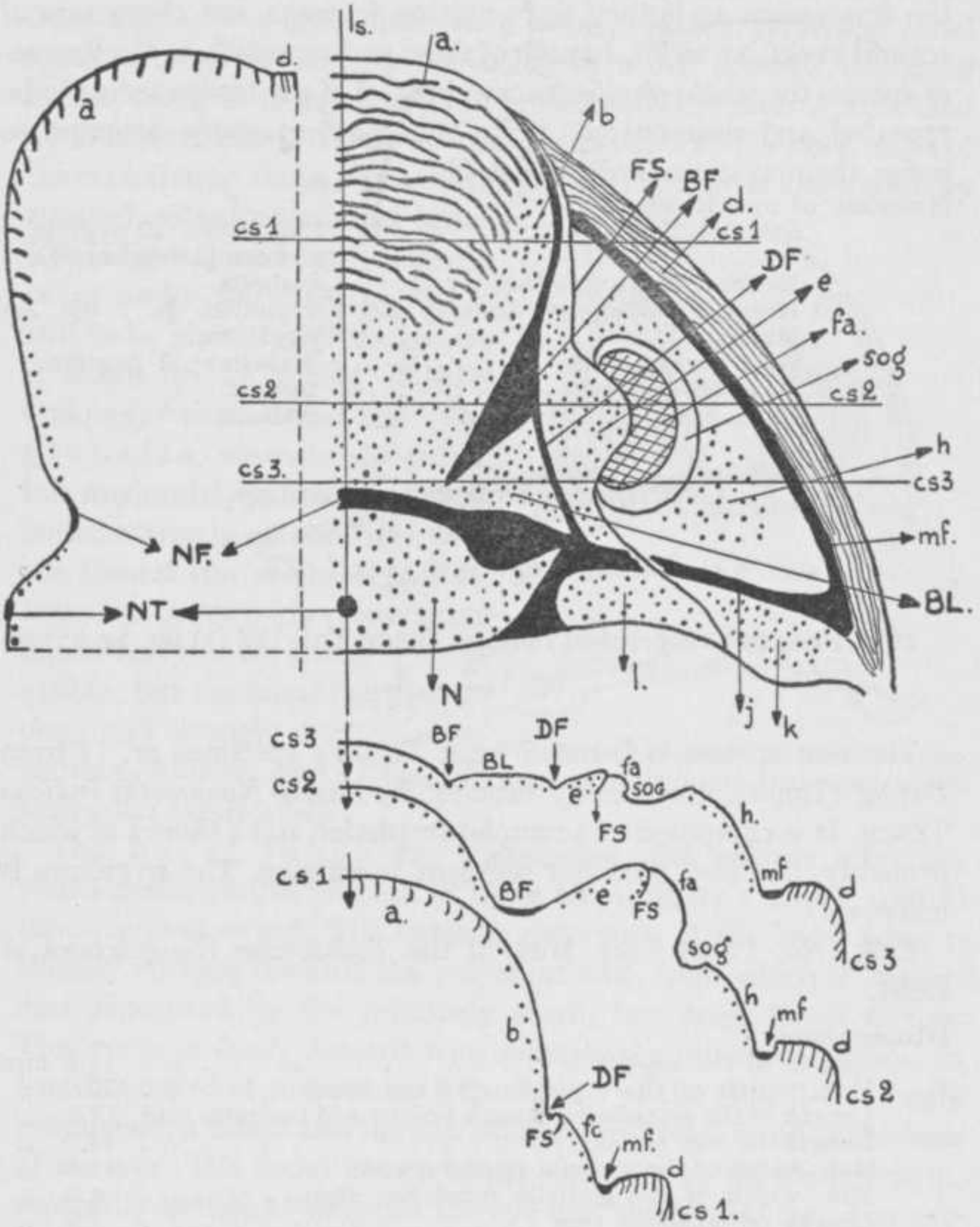


FIG. 21. *Griffithides verrucosus* GEMM.

h. punctated raised portion of the movable cheek; j. posterior furrow of the cephalon; k. erected posterior border of the free-cheek; l. erected posterior border of the fixed-cheek; ls. longitudinal section; mf. marginal furrow; N. punctated neckring; NF. Neck-furrow; NT. Neck-tubercle; sog. suboccular groove.

differing among them. As a matter of fact both these species make the impression as if they were uniting features and characters of several evolutive series. In each of them and especially in the timorese species the whole phylogenetical history of the family seems to be repeated and summarized. From this moment every attempt to range them systematically must fail.

Number of specimens:

Sth Cal Timor	17 glabellae, 22 pygidia and 1 complete specimen
Besleo (WANNER's locality 7) . .	1 glabella
Kiumoko (Wanner's locality 22)	1 cephalon (pl. I fig. 2*a*)
Mangan Tobe	1 pygidium
Siloe Netoe Kot.	2 glabellae; 2 pygidia
Siloe Nifoe Koko	1 thorax
Pantukat.	1 glabella.

***Griffithides baungensis* nov. sp.**

Plate II fig. 1*a-b*; textf. 22

1923 *Proetus* (*Neoproetus*) *indicus* TESCH Taf. 178 (1) fig. 5*a-b*; non fig. 1, 2, 3, 4.

The new species is founded upon TESCH's specimen nr. 17 from Baung (Timor), erroneously brought by him to *Neoproetus indicus* TESCH. It is composed of a complete cephalon and a thorax of which probably the last posterior segment is missing. The pygidium is unknown.

Coll.: No. 12804 Geol. Mus. of the Technische Hoogeschool at Delft.

Dimensions:

Length of the cephalon	17.5 mm
Max. width of the cephalon (at the base)	22.0 ,,
Length of the glabella with neck furrow and occipital ring	17.5 ,,
Length of the glabella.	14.0 ,,
Max. width of the glabella (anterior end)	11.0 ,,
Min. width of the glabella (posterior end).	4.0 ,,
Length of occipital ring	7.9 ,,
Max. width of occipital ring (about the centre)	2.7 ,,
Max. width of marginal limb	3.0 ,,
Length of faceted eye.	5.0 ,,
Width (Height) of faceted eye	3.5 ,,
Max. width of thoracic axis	7.9 ,,
Min. width of thoracic axis	7.0 ,,

Description. The c e p h a l o n is rounded triangular in outline, surrounded by a broad and well-differentiated marginal limb, which

is rectangularly bent downward, but still distinctly to be viewed from above. The limb must have been provided by strong genal spines, since it is strongly increasing in width towards the genal angles, where it is unfortunately broken off. The limb is separated by a distinct marginal furrow running parallel to the outer edge of the cephalon at about 1 mm. of the latter; The limb is longitudinally striated with fine parallel striae (Pl. II fig. 1*a*); anteriorly it disappears under the glabella, but is still to be viewed in front, where it seems to be folded slightly obliquely under the test. The g l a b e l l a, strongly elongated, but moderately gibbous in front, ends anteriorly at one level with the frontal rim of the cephalon; bounded by strongly constricting dorsal furrows. No lateral furrows visible; but the basal furrows are deep and strongly marked, separating prominent and elongated-triangular basal lobes.

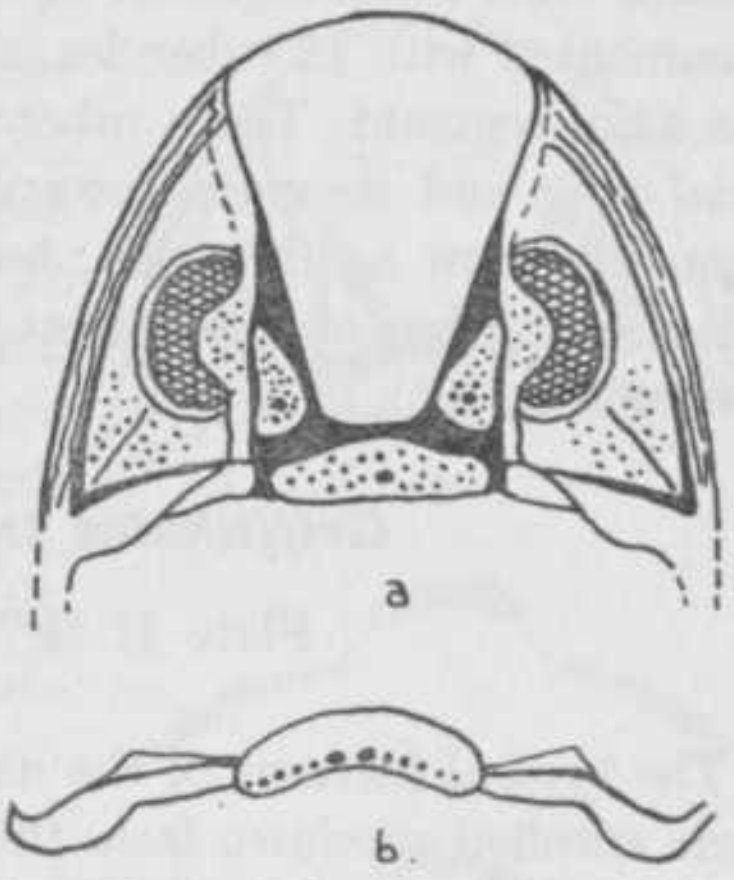


FIG. 22. Cephalon and thoracic segment of *Griffithides baungensis n. sp.*

The b a s a l l o b e s are ornamented with minute tubercles, which are largest at the top of those lobes, where a larger, central tubercle is observed, The exterior extremity of the basal lobes is slightly curving towards the palpebral lobe, from which it is however separated by the relatively small, but deep dorsal furrow. The e y e is finely faceted with remarkably minuscule facets; in length somewhat more than $\frac{1}{3}$ the length of the glabella; strongly prominent; a broad and smooth suboccular groove lying at the base of the eye. The facial suture is not visible over its whole length, especially indistinct between the eye and the frontal rim; but surrounding with a strong curvation the relatively small palpebral lobe which is also finely granulated.

The posterior field of the f r e e c h e c k is also granulated; strongly convex; relatively small; a distinct ridge is extending diagonally from the eye towards the genal angle.

O c c i p i t a l r i n g: broad and swollen; separated by a moderately broad and deep neck-furrow from the base of the glabella;

finely granulated over its whole surface; a minute necktubercle is shown in its central part. The neckfurrow directly continuing on the furrow, separating the posterior border of the cephalon from the free check; this posterior border is completely smooth.

T h o r a x: probably composed of 9 free segments of which the posterior one is missing. The median lobe, exceeding in width the pleural lobe. Each segment of the thoracic axis being remarkably ornamented with 12 tubercles, standing on the posterior margin of the axial segment. These tubercles are largest in the midts of the axial ring and decrease towards the dorsal furrow. The pleural segments show no furcation; but are much larger on the outward side, (where they obliquely bent posteriorly), than towards the dorsal furrow (fig. 22*b*).

***Griffithides trigonoceps* n. sp.**

Plate II fig. 2*a-b*, textf. 23

The typical features of the new species are derived from a complete enrolled specimen from the locality of Siloe Netoe Kot in Sth C^{al} Timor.

Dimensions. The cephalon being slightly crushed, only part of the dimensions can be given with security.

Length of glabella with occipital ring and neckfurrow . . .	14	mm
Length of glabella.	11	,,
Length of occipital ring	8.2	,,
Max. width of occipital ring	2.8	,,
Max. width of glabella (anteriorly)	10.0	,,
Max. width of glabella (at the base)	3.0	,,
Length of faceted eye	5.0	,,
Width (height) of faceted eye	3.0	,,
Max. width of marginal border.	2.5	,,
Length of basal lobe	3.0	,,
Max. width of basal lobe	2.0	,,
Width of thoracic axis (anteriorly)	7.5	,,
Width of thoracic axis (posteriorly).	6.–	,,
Width of pygidial marginal border	2.5	,,

Description. The c e p h a l o n is sub-semicircular in outline; the convexity of the marginal borders of the free checks being relatively low; surrounded by a broad and well-differentiated marginal limb, which is bent vertically downward, but still distinctly to be viewed from above. The limb was probably produced backward into strong genal spines. The limb longitudinally striated by fine parallel striae, is separated by a shallow marginal furrow, running

parallel to the outer edge of the cephalon at about 1 mm of the latter.

The g l a b e l l a lying anteriorly at one level with the frontal rim of the cephalon is triangular in form; the frontal and lateral sides being of equal length (about 10 mm) and the angles between them measuring precisely 60°. The lateral sides are thus strongly constricting backward and the general form of the glabella is an equilateral triangle. The glabella is moderately gibbous over its whole length. No lateral furrows visible; but the furrows separating the basal lobes are deep and strongly marked. Te b a s a l l o b e s are prominent and elongated triangular in form; their anterior extremity pointing towards the palpebral lobe from which it is however separated by the relatively broad dorsal furrow. Glabella, palpebral and basal lobes bear no ornamentation of any kind.

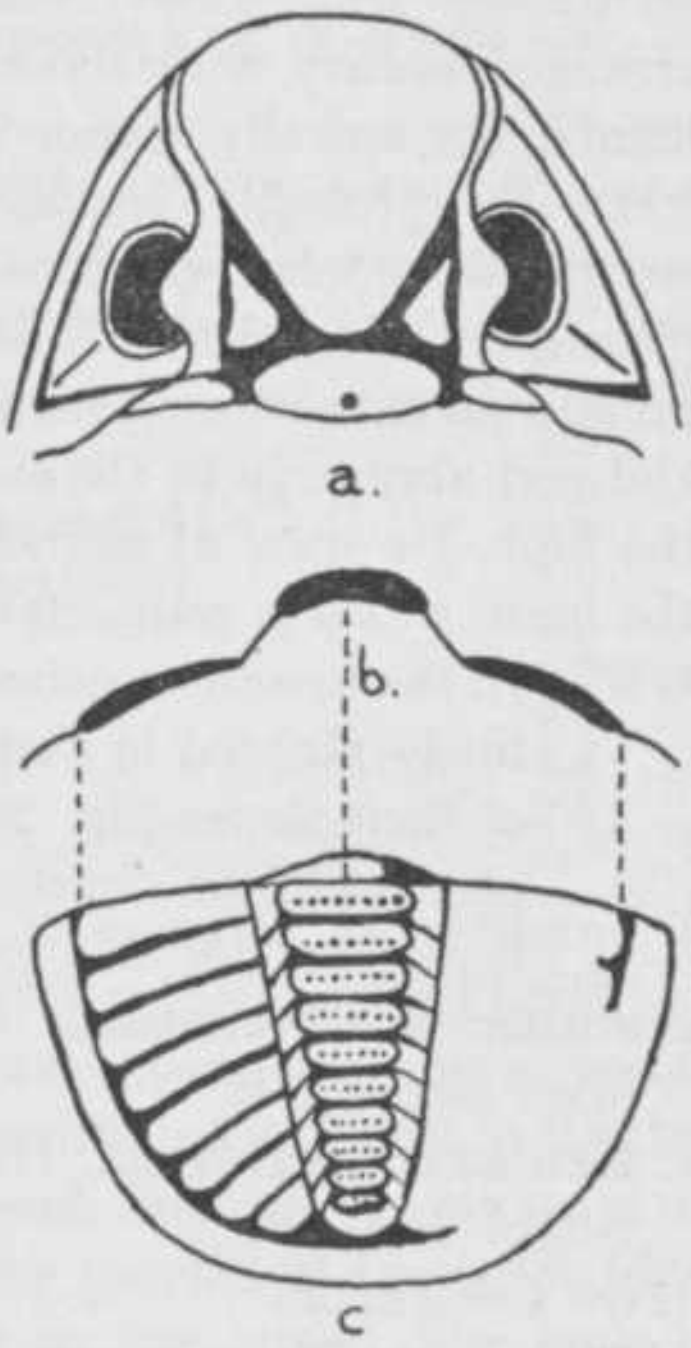


FIG. 23. *Griffithides trigonoceps* n. sp.

The o c c i p i t a l r i n g is broad and swollen; separated from the base of the glabella by a broad and deep neckfurrow. No ornamentation is to be seen, except a minute centralneck-tubercle.

The e y e s and the palpebral lobes are strongly prominent. The surface of the eyes is finely faceted. The sub-occular groove is broad and well-marked. The facial suture is the typical one of most *Griffithidae*. In surrounding the frontal expansion of the glabella it shows a slight curving outward between the eyes and the frontal rim.

The f i e l d o f t h e f r e e c h e e k is strongly raised; smooth; a diagonal ridge running distinctly from the eye towards the genal angle.

The t h o r a x is relatively long and consists of 9 free segments. No ornamentation. The median lobe is moderately arched. The pleural segments are somewhat larger in the extern portion than towards the dorsal furrows.

Pygidium semicircular in outline; surrounded by a broad and well-marked marginal limb, which is bent obliquely downward (fig. 23) and distinctly separated from the rest of the pygidium by a well-marked marginal furrow. The pygidial axis is differentiated in a strongly segmented crest and two lateral bands with much weaker segmentation. Each crestal segment is ornamented on its top with 6 or 7 relatively large tubercles, arranged lineary with those of the other axial segments. The apically rounded axis is composed of at least 10 (probably no more) coalesced segments, separated by relatively broad and deep furrows. The pleural lobes consist of 7 or 8 strongly marked and broad segments, which geniculate in the dorsal furrows and end abruptely in the marginal furrow separating the limb. No trace of segmentation is to be seen on the limb, which is completely smooth.

FIG. 24.
Striation of the basal furrow.
BL, *basal lobe.*
GL, *Glabella.*

OBS. In the present specimen the basal furrows are finely striated in their deepest parts and on the lower sides of their slopes (fig. 24). This phenomenon, which I often observed less clearly in other species, is distinctly exhibited here. I am not able to give any explanation to it.

Number of Specimens.

Siloe Netoe Kot	1	complete specimen.
Kiumoko (locality 22, Bonn)	1	pygidium.
Niipol Soempek	1	id.
8th Cal Timor	1	id.

Remarks: The present specimen doubtessly shows close resemblances to *Griffithides baungensis*. The main differences consist in the remarkable different form of the glabella and in the complete lack of cephalic and thoracic ornamentation. The equilateral triangular form of the glabella is the most typical feature and can be considered as an extreme stage in the glabellar evolution. Although ending backwardly in a more pointed extremity (in the neckfurrow), it might nevertheless be considered as a first transitional form between forms with strongly elongated glabella and relatively large glabellar base and such ones with beginning shortening of the glabella (thus transitional between the longiceps and the shortened glabella).

Griffithides gerthi n. sp.

Plate II fig. 3*a-c* textf. 25

The new species is founded upon a complete enrolled specimen from the permian beds of Besleo in the southern district of Central Timor.

Dimensions: The cephalon being slightly crushed, especially in the glabellar region only few cephalic dimensions can be given with security:

Length of cephalon	11.5 mm
Max. width of cephalon (posterior border)	20.0 „
Length of glabella with neck-furrow and occipital ring	11.5 „
Length of glabella	± 8. „
Max. width of glabella (anteriorly)	9.5 „
Min. width of glabella (posteriorly)	± 5.0 „
Length of occipital ring	7.0 „
Width of marginal limb	3.0 „
Length of thorax	20.0 „
Max. width of thoracic axis (anteriorly)	7.5 „
Min. width of thoracic axis (posterior segment)	7.0 „
Length of pygidium	11.0 „
Width of pygidium (anteriorly)	16.5 „
Length of pygidial axis	9.6 „
Max. width of pygidial axis (anteriorly)	6.4 „
Min. width of pygidial axis (posteriorly)	3.5 „
Width of pygidial marginal limb	2.0 „

Description. The cephalon is rounded trapeziform in outline, being nearly twice as broad as long; the marginal border of the free cheek but moderately convex; surrounded by a broad marginal limb, which is distinctly differentiated and bent vertically downward, but still partly to be viewed from above, where it is separated by a marginal furrow running parallel to the outer edge of the cephalon at about 1.5 mm from the latter. The limb is striated longitudinally and probably produced into strong genal spines. In the posterior edge of the cephalic shield the folding of the limb under the text is distinctly to be seen (fig. 25*c*). The glabella anteriorly expanded and reaching to the frontal rim of the cephalon, but not overhanging it; laterally bounded by but moderately backward constricting furrows. The base of the glabella is relatively broad.

The field of the movable cheek is fairly raised; a diagonal ridge being exhibited between the eye and the genal angle. The suboccular groove is broad and well-marked. The eyes are comparatively small, very prominent, seemingly smoothed. The facial suture showing an expansion between the eyes and

the frontal rim. The posterior end is remarkably developed. On cutting the posterior border of the cephalon it obviously differentiated clearly the posterior border of the free cheek from that of the fixed cheek. The latter is well- differentiated-but narrow and curving backward along the facial suture. The posterior border of the movable cheek is less distinctly differentiated, but much larger in width. The facial suture follows its marginal border; at about the bending point it disapears under the test and continues on the under side towards the genal angle. (fig. 25*a*).

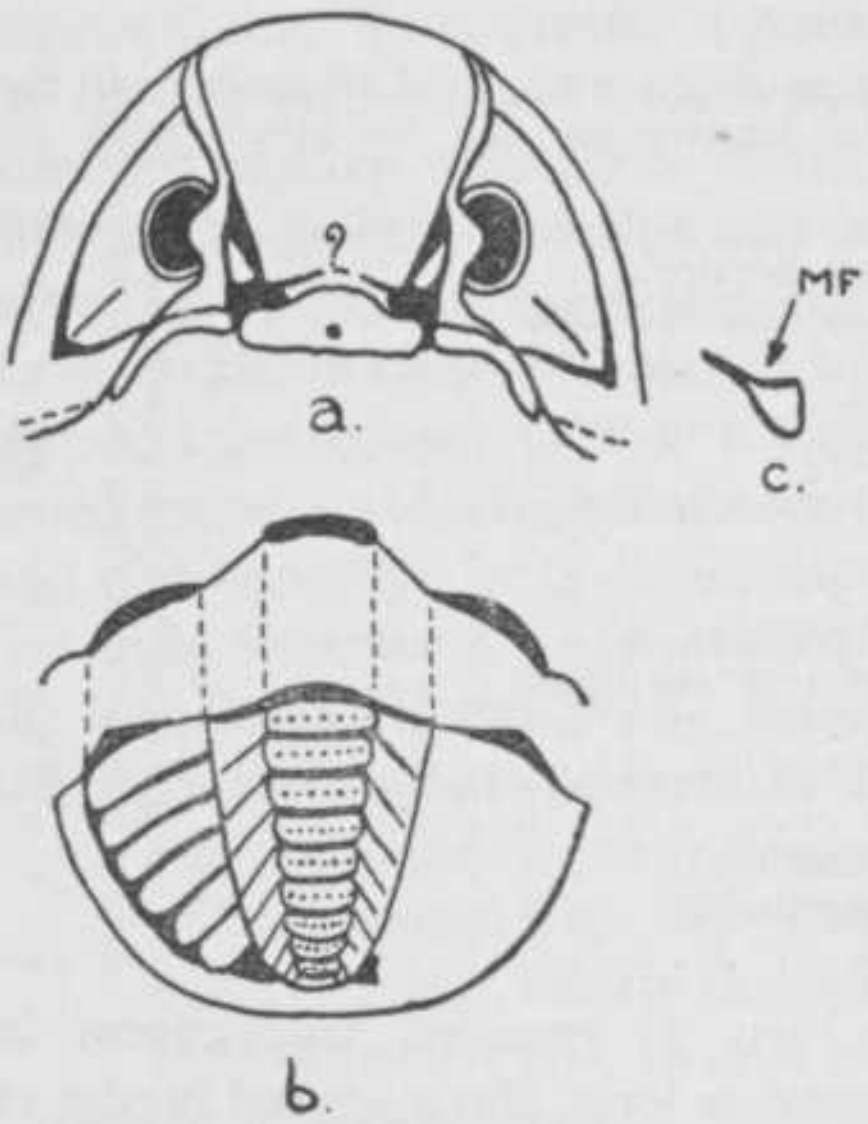


FIG. 25. *Griffithides gerthi n. sp.*
MF marginal furrow

The basal lobes separated by a broad furrow from the glabella; elongated triangular in form; moderately prominent; lying in the proximity of the palpebral lobe from which it is separated by a relatively narrow dorsal furrow.

The occipital ring is broad and swollen, expecially in its central part, fairly prominent, bearing a minute neck-tubercle.

Ornamentation. The surfaces of the glabella, the palpebral and basal lobes have seemingly no ornamentation, but the glabella and the frontal part of the marginal limb, exhibit, under a magnifier, numerous fine pores, regularly distributed over the whole surface. On the marginal limb, these pores seem to be situated very regularly between the longitudinal striae.

Thorax: composed of 9 free segments; median axis slightly exceeding in width the pleural lobes. The dorsal furrows are nearly parallel, but moderately constricting backward.

Pygidium much broader than long; semi-elliptical in form with the longer axis transverse to the body; surrounded by a broad and completely smooth marginal limb, whose convexity seems to become smaller at the caudal end. The limb is curved and bent obliquely downward.

The p y g i d i a l a x i s, broad, conposed of 9 coalesced segments; differentiated in a strongly segmented crest and 2 lateral bands with much weaker segmentation. The crestal segments, apically but slightly rounded, seem to be reversed in backward direction; each of them is ornamented with 6 or 7 tubercles; segments separated by broad and deep furrows.

The pleural segments in number of 6 are broad and separated by broad and deep furrows; they geniculate in the dorsal furrows and are more prominent at about the centre of the pleural lobe, thus increasing the convexity of this limb. Ending abruptely in the marginal furrow and thus separating the smooth and curved limb.

***Griffithides breviceps* n. sp.**

Plate III fig. 1*a-b*, textf. 26

The typical features of the new species are derived from 2 complete specimens, discovered in the permian Besleo-beds in the southern district of central Timor.

Dimensions: The dimensions of the extremely well-preserved holotype are given here.

Length of cephalon	11.0	mm
Max. width of cephalon	15.2	„
Length of glabella with neckfurrow and occipital ring	11.0	„
Length of gibbous anterior portion of the glabella	7.2	„
Max. width of glabella	7.0	„
Length of occipital ring	5.0	„
Max. width of occipital ring	2.0	„
Length of facetal eye-surface	3.8	„
Width of marginal limb	1.5	„
Length of thoracic axis	15.0	„
Max. width of thoracic axis (anteriorly)	4.8	„
Min. width of thoracic axis (posteriorly)	4.0	„
Length of pygidium	11.0	„
Max. width of pygidium (anteriorly)	14.8	„
Length of pygidial axis	9.0	„
Max. width of pygidial axis (anteriorly)	4.0	„
Min. width of pygidial axis	2.0	„

Description. The c e p h a l o n is rounded-triangular in outline and surrounded by a less-good differentiated marginal limb. The latter is bent vertically downward, covered with parallel, longitudinal striae and posteriorly produced into genal spines.

The g l a b e l l a anteriorly lying at one level with the frontal rim of the cephalon, where the marginal limb is however distinctly differentiated by the still visible marginal furrow; the glaballe is

relatively short, differentiated by a complicated system of glabellar

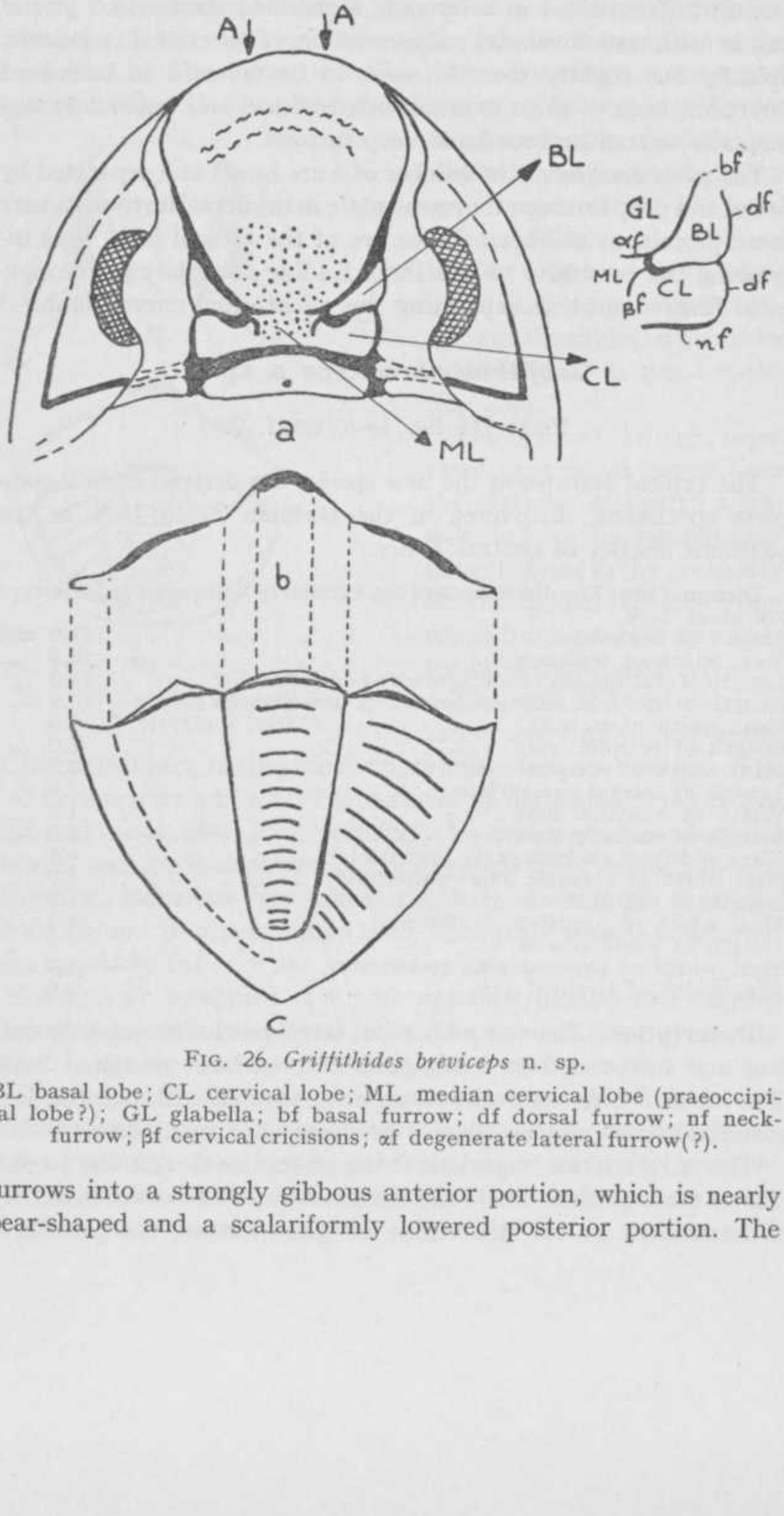


FIG. 26. *Griffithides breviceps* n. sp.

BL basal lobe; CL cervical lobe; ML median cervical lobe (praeoccipital lobe?); GL glabella; bf basal furrow; df dorsal furrow; nf neck-furrow; βf cervical cricisions; αf degenerate lateral furrow(?).

furrows into a strongly gibbous anterior portion, which is nearly pear-shaped and a scalariformly lowered posterior portion. The

latter is also differentiated into a central prolongation of the glabella (fig. 26 ML) and two laterally adherent, wing-like appendages (fig. 26 CL), partly separated from the former by the backwardly curving prolongations of the basal furrows (fig. 26 bf).

At the base of the gibbous glabellar portion and in front of the wing-like appendages are situated on each side of the glabella, hardly prominent basal lobes (fig. 26 BL).

The glabella is ornamented on the frontal side with short irregular transverse wrinkles and, on its posterior side with fine pustules, which are also exhibited on the central lowered prolongation of the glabella, while the lateral wing-like appendages, alluded to, are completely smooth.

The occipital-ring is comparatively small, moderately broad and swollen and bearing a central neck-tubercle, without further ornamentation.

On account of the low prominence of the different lobes lying in the occipital depression, the neck-furrow can easily be confounded with the whole cervical depression between the anteriorly gibbous glabella and the occipital ring. In fact the neckfurrow is relatively small and narrow, although easily distinguishable by its greater depth. The neckfurrow is not directly continued into the furrow lining the base of the movable cheek. The furrow separating the posterior border of the relatively large fixed cheek is less distinct and vanishing in a seemingly broader and shallow depression.

The eyes are moderately large, reniform and finely faceted. The facetal areas are strongly erected, while the palpebral lobes are less prominent on account of a flattened extension of the fixed cheeks. The facial suture is the typical one of the genus *Griffithides*. A moderate outward expansion is to be seen between the eye and the frontal rim. Anteriorly the facial suture cuts the marginal limb under a very small angle and disappears under the test at relatively neighbouring points (fig. 26 A).

The thorax is composed of 9 free segments. The median lobe is comparatively narrow and bounded by but slightly backward constricting dorsal furrows. The pleural segments are furcated on their inner portion.

The pygidium is subtriangular in outline; the marginal border showing rather a lower convexity than in most *Griffithidae*; at the caudal, end the pygidium becomes more angular. The limb is

rather rudimentary; not differentiated by a distinct marginal furrow, but by a slight horizontally outward bending of the pleural lobe. Anteriorly the edges of the pygidium are not rounded but distinctly pointed.

The pygidial a x i s is segmented only on the apically rounded crest, where 14 or 15 coalesced segments are to be counted. Anteriorly the axial segments are separated by rather deep furrows. In backward direction the separation of the segments is less clear. The caudal end of the axis is not overhanging the limb.

The p l e u r a l l o b e s are indistinctly segmented, when the shell is removed the segmentation is however clearly exhibited and consists of 10 or 11 broad pleural ribs, separated by rather narrow furrows. The pleural segmentation vanishes completely in the marginal region at the bending point of the pleural lobe, thus differentiating the rudimentary marginal limb.

The test of the pygidium is seemingly smooth. In the second specimen a very fine pustulation is however exhibited on both the axial and pleural segments.

Discussion. The specimens described here as *Griffithides breviceps* on account of their evidently shortened glabella, present in many respects a remarkable development and differentiation among the permian trilobites. It is difficult to state with security if the new species is rightly brought to *Griffithides*. The slight sinuosity of the furrows bounding laterally the glabella together with the number of segments in the pygidial axis might have justified a rapproachment to *Phillipsia*. The shortened glabella and the rudimentary development of cervical lobes are on the other side characters typical for the subgenus *Pseudophillipsia*. In bringing the present species to *Griffithides* (*Griffithides*) I intended to claim the nearer affinities to the subgenus *Pseudophillipsia* and especially the remarkable transitional position of those timorese individuals. As a matter of fact it seems impossible to define the true nature and significance of the lobes and furrows developped between the glabella and the occipital ring. If the rudimentary lobes, I termed here "cervical" ones, are really to be compared with the lobes in the widened neck-furrow of the forms with shortened glabella (praeoccipital and basal-lobes of WEBER), then it seems highly probable that WEBER's interpretation of those lobes is erroneous, since in *Griffithides breviceps* a pair of true basal lobes seems to be exhibited in front of the cervical lobes.

Or should it be that the lobes between the glabella and the cervical lobes must be considered as l a t e r a l lobes separated from the glabella, after the separation and migration of the b a s a l ones? In that case *Griffithides breviceps* would represent the highest evolutive stage of the trilobite-glabella. Although such a conclusion may seem untimely (since the strange behaviour of *Griffithides breviceps* might as well be explained by a specialisation and degeneration analogous to that of *Griffithides indicus* and *Griffithides verrucosus*), I am enclined to consider *Griffithides breviceps* as a more specialised differentiation of the youngest trilobites. The pointed outline of the pygidium, the number of segments in the pygidial axis and the striking aberrancy in the configuration of the glabella can be put forward in support of this opinion. The indistinct segmentation of both the pygidial axis and pleural lobes is a feature proving against this supposition; but it can be doubted if the deepening of the pygidial furrows is effectively to be considered as a general tendency in the evolution of the youngest trilobites (cf. WELLER 1937 and WANG 1937).

Attention should at last be drawn upon the remarkable similarity in the ornamentation of the glabella in *Griffithides breviceps* and *Griffithides indicus* TESCH.

***Griffithides breviceps* n. sp. *var. axistriata* nov. var.**

Plate III fig. 2 and 3

This variety is based upon a complete specimen and 1 lose pygidium from the surroundings of Besleo in South Central Timor. It differs only from the specific holotype in the ornamentation of the pygidium and the relatively clearer differentiation of the pygidial marginal limb. Each segment of the pygidial axis is ornamented with 7 fine elongated, ridge-like tubercles, which are arranged lineary in longitudinal direction on the consecutive segments, so as to make the impression of a striation of the pygidial axis. The lateral surfaces of the axis and the pleural segments are furthermore very finely granulated.

Since the same ornamentation of the pygidial axis may be exhibited in several forms and is by no means particular to a definite genus I preferred to consider it as a morphological feature of secondary importance. In basing upon the present species a new variety

I intended to emphasize the peculiar kind of pygidial ornamentation shown by the timorese specimens, described here.

Griffithides brevicauda n. sp.

Plate IV fig. 1*a-b*; textfig. 27

The new species is founded upon a complete enrolled specimen from the permian Besleo-beds in the southern district of Central Timor (Coll. Geological Institute of Amsterdam).

Dimensions:

Length of the Cephalon	9.5	mm
Max. width of the cephalon (at the base)	13.5	„
Length of the glabella with neck-furrow and occipital ring	9.5	„
Length of glabella	6.8	„
Max. width of the glabella (anteriorly)	5.–	„
Min. width of the glabella (at the base)	1.–	„
Length of occipital ring	5.–	„
Max.. width of occipital ring (about the middle)	1.8	„
Width of marginal limb	1.5	„
Length of the eye	3.8	„
Width (heigth) of the eye	1.–	„
Length of the thorax	14.–	„
Max. width of thoracic axis (anteriorly)	5.–	„
Min. width of thoracic axis (posteriorly)	3.4	„
Length of pygidium	6.–	„
Max. width of pygidium	10.–	„
Width of pygidial axis (anteriorly)	3.5	„
Width of pygidial axis (posteriorly)	1.5	„
Length of pygidial axis	6.–	„
Width of the marginal border of the pygidium	1.8	„

Description: The cephalon is semi-circular in outline; the outer border of the free cheeks having a very low convexity (fig. 27*a*) The cephalon is surrounded by a large and prominent border, which is differentiated from the free cheeks by a deep marginal furrow. On the posterior side of the cephalon the posterior border is likewise strongly differentiated by a deep furrow, which seems to continue directly into the neck-furrow. The marginal limb is striated longitudinally with parallel striae and but partly to be viewed from above on account of its being folded vertically downward. Anteriorly this cephalic limb disappears under the glabella, which lies at one level with the frontal rim. The continuance of the limb is however still to be viewed in front by its distinct striation. Backwardly the limb must have been produced into strong genal spines.

The g l a b e l l a is rounded, pear-shaped in form, having its largest expansion in the anterior part, at about the height of the marginal furrow. Strongly constricting in backward direction. The glabella is moderately gibbous in its frontal part and is tapering gradually towards the neck-furrow. No lateral furrows are visible, but the furrows separating the basal lobe are deep and strongly marked. Superficially the glabella seems to be completely smooth but the ornamentation might have been destroyed by corrosion. This is the more probable as a fine granulation of small pustules is still to be seen on the basal lobe and in the posterior field of the movable cheek.

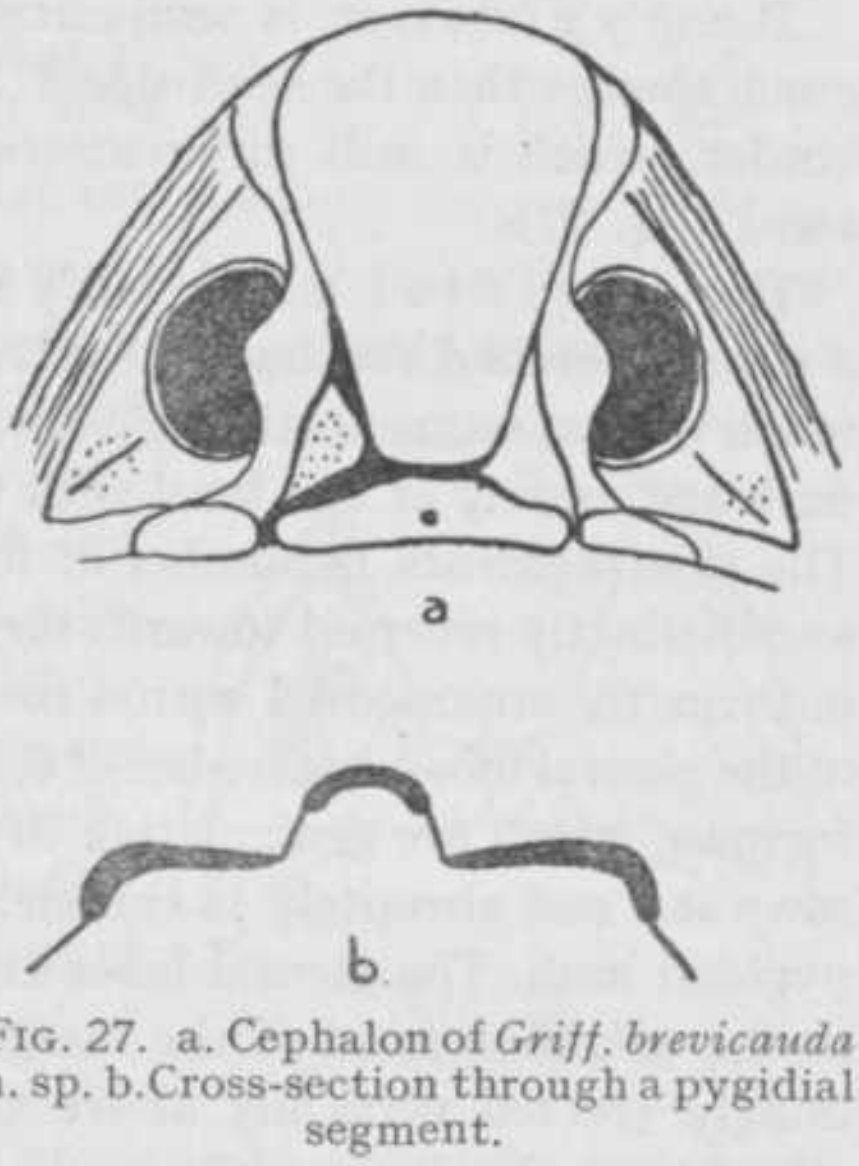


FIG. 27. a. Cephalon of *Griff. brevicauda* n. sp. b. Cross-section through a pygidial segment.

Remarkably there is but one b a s a l l o b e developed (fig. 27*a*). It is elongated triangular in form; its base being parallel to the contour of the glabella and its top being directed obliquely outward. It is completely separated from the glabella on the one side and from the palpebral lobe on the other. The basal lobe is ornamented with fine pustules.

The o c c i p i t a l r i n g is broad and swollen; separated from the glabella by a broad but shallow neckfurrow; bearing one central tubercle, without further ornamentation.

The e y e s are relatively large, being but slightly smaller than half the length of the glabella. Superficially the eyes are completely smooth. The sub-occular groove is narrow but well marked. The f a c i a l s u t u r e is the typical one of all *Griffithidae*, at least in its general course, although the lateral expansion between the eyes and the frontal border seems to be comparatively wide. The f r e e c h e e k s exhibiting a small diagonal ridge in their genal field, are relatively small on account of the low convexity of the marginal border and the large dimensions of the eye-lobes.

The t h o r a x is composed of 9 free segments; The median axis

is slightly wider than the pleural lobe. The pleural segments are furcated on their inner portion. Proportionally the thorax has much larger dimensions than the cephalon and the pygidium. Their proportional lengths being nearly 5 : 7 : 3.

The p y g i d i u m is semi-circular in outline; wider than long; much smaller than the head-shield. Surrounded by a broad marginal border, which is well differentiated and oriented obliquely outward (fig. 27*b*).

The p y g i d i a l a x i s fairly raised is clearly differentiated in a strongly arched and segmented crest and in two lateral bands with much weaker segmentation. Backwardly the axis is overhanging the limb and ending at one level with the caudal end of the pygidium. The axial segments, in number of 10, are separated by deep furrows and distinctly reversed towards the back .Each of them seems to be indistinctly ornamented with a row of fine granules. The segments of the pleural lobes, in number of 6, are broad and separated by deep furrows, which are geniculating in the proximity of the dorsal furrows and end abruptely in the marginal depression, separating the pygidial limb. The pleural lobes are strongly prominent, especially in the neighbourhood of the marginal furrow, where they are seemingly erected vertically above the limb. The limb is not curved and is completely smooth.

Remark. The development of but one basal lobe may be interpretated as a pathological feature or as a peculiarity of degenerative significance. It can by no means be considered as of systematical value, neither in a generic nor in a specific ways. In its whole configuration *Griffithides brevicauda* remembers a more primitive stage and can doubtessly be rapproached to the forms with a longiceps glabella. Especially the small number of pygidial segments is in complete agreement with the elementary form of the glabella.

***Griffithides teschi* n. sp.**

Plate IV fig. 2*a-b* textf. 28

The new species is founded upon a complete, enrolled specimen from the permian Besleo-beds in the southern district of Central Timor. (Coll. Geological Institute of Amsterdam).

Dimensions: The specimen having been crushed only few dimensions can be given with security:

Length of the cephalon	10	mm
Max. width of the cephalon (at the base)	18.5	„
Length of the glabella, with neck-furrow and occipital ring	10.–	„
Length of the glabella	7.5	„
Max. width of the glabella (anteriorly)	8.5	„
Min. width of the glabella (at the base)	2.5	„
Length of occipital ring	6.5	„
Max. width of occipital ring (about the middle)	1.5	„

Description: The cephalon is semi-circular in outline, surrounded by a relatively small limb, which is distinctly separated by a deep marginal furrow and is bent obliquely under the test. Backwardly the limb was probably produced into genal spines. The glabella is triangular in outline, rounded in front and slightly overhanging the limb, which is however still to be viewed in front. The glabella is strongly constricting backwardly and fairly prominent. On each side of it, at nearly one level with the cervical furrow, a very small basal lobe is to be seen, which is but moderately prominent, although completely separated from the glabella and from the palpebral lobe. The eyes are relatively large, being more than one third the length of the glabella. The t h o r a x, relatively long is composed of 9 free segments.

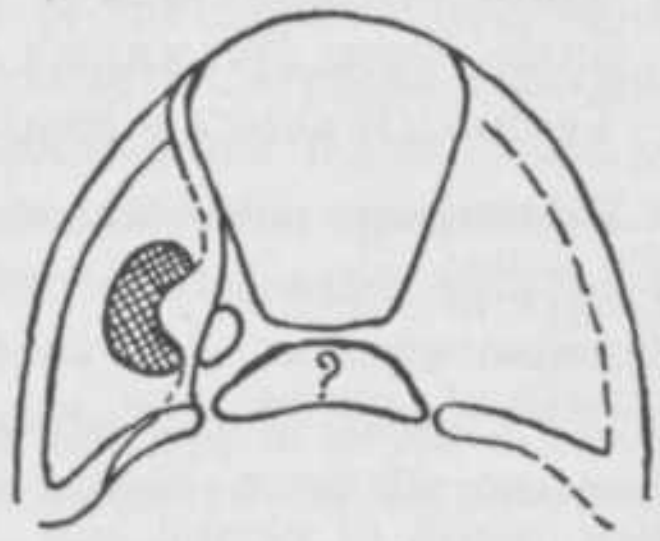


FIG. 28.
Griffithides teschi n. sp.

The p y g i d i u m is much smaller than the cephalon; surrounded by a flattened and smooth marginal limb. The pygidial axis is composed of 8 or 9 coalesced segments, separated by deep furrows. The pleural lobes consist of 5 large and broad segments, which geniculate in the dorsal furrows and end abruptely in the depression, separating the pygidial limb.

Affinities and Differences. The present species shows a close resemblance to *Griffithides brevicauda*. The differences are however too evident, even in the crushed representative, that it might in any way be identified with it. In the configuration of the glabella and the latter's proportional dimensions, it differs completely from *Griffithides brevicauda*. The convexity of the cephalic border is also much larger and the form and prominence of the basal lobes are

completely different. In the pygidium the new species exhibits a still smaller number of both axial and pleural segments.

Griffithides (Pseudophillipsia) timorensis n. sp.

Plate IV fig. 4

The new species is represented in my collection by a large and complete pygidium and besides by several less good preserved pygidia of smaller dimensions from the following localities:

South Central Timor . . . . . 7 pygidia
Suzie Mepu (WANNER's locality 19) 1 pygidium
Tunino (WANNER's locality 16). . . 1 pygidium.

Dimensions of the largest specimen; the others being proportionally the same.

Length of pygidium	23	mm
Anterior width	20	„
Length of pygidial axis	21	„
Anterior width of pygidial axis	7.5	„
Posterior width of pygidial axis	2.5	„
Max. width of pleural lobe	6.5	„
Width of marginal limb	1.5	„

Description. The pygidium is elongated triangular in outline, the convexity of the marginal borders being very low. At the caudal end, the pygidium is more angularly pointed. The axis is elevated, especially prominent in backward direction, where it is slightly overhanging the limb; rounded at the top; marked by 24 coalesced segments .The axial segments are separated by narrow well-defined furrows, geniculating on the top of the lateral sides of the axis, which are furthermore completely smoothed. Through the geniculating points of the axial segments runs a slight depression extending throughout the whole length of the lateral side of the axis and thus separating a completely smoothed band. The crestal segments bear 7 or 8 small modules, elongated in longitudinal direction and arranged lineary with the nodules of the other segments. This ornamentation vanishes on the posterior segments and tends to disappear completely on the caudal ones. The pleural lobes (including the marginal limb) are slightly larger in width than the axis. Marked by 15 or 16 broad ribs. The segments of the pleural lobes geniculate in the proximity of the dorsal furrows, near which they are however slightly smoothed. They become more and more

distinct towards the centre of the pleural lobe and vanish again towards the marginal furrow separating the limb. The segments of the pleural lobes bear no ornamentation but this may have been destroyed afterwards, as another fragmental pygidium of the same locality shows also lineary-arranged nodules on the pleural ribs, wholly identical to those of the axial segments.

L i m b: flat, moderately wide; largest width at the caudal end of the pygidium. Well-differentiated from the strongly convex pleural lobes by a distinct marginal furrow. This differentiation is however vanishing in the anterior part of the pygidium.

Affinities and Differences. None of the timorese species described by Tesch (1923) can be compared with the present specimen. *Phillipsia* (*Pseudophillipsia*) *sp. aff. obtusicauda* KAYS. could probably be reckoned to the new species, but this specimen is too badly conservated to state the complete identification without any restriction. The described specimen doubtessly belongs to the subgenus *Pseudophillipsia* GEMM. I thus agree with TOUMANSKY (1935) that the diagnosis of this subgenus, as given by GEMMELLARO, (1892) should be enlarged in order as to enclose also species with rounded pygidial axis. TOUMANSKY laid however to much value upon this rounding of the axis, where he effectively founded upon it several varieties. Compare for instance the differences between *Pseudophillipsia mustafensis* TOUM. and its variety *sarabansis* TOUM. and also between *Pseudophillipsia elegans* GEMM. and *Pseudophillipsia elegans* GEMM. var. *ibrishensis* TOUM. I also agree with TESCH (1916) that it should be taken into consideration to identify completely several species described anteriorly as *Pseudophillipsia*. Fuller information must however be awaited for such identifications, since among the representatives of *Griffithides* (*Pseudophillipsia*) several species may have an absolutely identical pygidium and exhibit, at the same time, cephalic shields completely differing among them.

B. Sicily

GEMMELLARO (1892) described the following species from the permian Fusulina-limestone of the Sosio-valley in Sicily:

Proetus postcarbonarius GEMM., brought by TOUMANSKY (1935) to *Permoproetus* TOUM. and by the author to the subgenus *Proetus* (*Permoproetus*) TOUM.

Phillipsia sicula GEMM., reckoned by TOUMANSKY to *Neogriffithides* TOUM. and considered by the author as a typical representative for an aberrant group of *Phillipsia* PORTLOCK.

Griffithides verrucosus GEMM., the predominant species among the sicilian trilobites. It was brought by TESCH (1923) to the subgenus *Proetus* (*Neoproetus*) TESCH; but has, in the author's opinion, to be considered as a true *Griffithides*.

Pseudophillipsia elegans GEMM. belonging to the same group as *Griffithides* (*Pseudophillipsia*) *sumatrensis* ROEM., *Griff.* (*Pseudoph.*) *timorensis* n. sp. and *Griff.* (*Pseudoph.*) *obtusicauda* KAYS.

Phillipsia oehlerti GEMM., *Phillipsia sosiensis* GEMM., and *Phillipsia pulchella* GEMM; all represented by lose pygidia and differing to an high degree from the permian trilobites of other regions.

It may be mentioned here as a striking particularity of the sicilian tribolites, that all the species are represented by very small individuals. Since these dwarfish sizes are a general peculiarity of the whole sicilian fauna, we are entitled to consider the latter as a so-called „miniature„-fauna, without being able of giving a satisfactory explanation for this regionally limited phenomenon.

Griffithides verrucosus Gemm.

Plate I fig. 5, 6 textf. 21 and 29

1892 *Griffithides verrucosus* GEMM. 1892 p. 12 Tav. II fig. 6 à 12.
1916 *Proetus* (*Neoproetus*) *verrucosus* GEMM (TESCH 1916 p. 610).
1923 *Proetus* (*Neoproetus*) *verrucosus* GEMM. (TESCH 1923 p. 131).
1935 *Neoproetus verrucosus* GEMM. (TOUMANSKY 1935).

This species is represented in my collection by a glabella and two pygidia and besides by a well preserved, almost complete headshield (Pl. I fig. 5), discovered in the Permian Fusulina-Limestone at the locality of Palazzo Adriano in the province Palermo (Sicily). Coll. Geol. Institute Amsterdam.

DIMENSIONS: The dimensions of this remarkable sicilean species are very important on account of some remarks made anteriorly.

	Length in mm	Breadth in mm
cephalon	5.5 (a)	10 (a)
glabella	4.1 (a) 5 (b)	3.2 (a) 4 (b)
pygidium	6 (c) 4.5 (d)	9 (c) 6 (d)

These dimensions are nearly the same as those measured by Gemmellaro (1892 p. 13) and demonstrate clearly the dwarfish sizes of the sicilean *Griffithidae* in comparison with those of other regions.

Description. The cephalon is nearly semi-circular, somewhat triangular in general outline; provided with a large limb, which is well-differentiated by a rather deep marginal furrow, especially along the marginal borders of the movable cheeks, where the limb is easily to be viewed from above. The limb is covered with parallel striae, running slightly obliquely to its longitudinal direction. In the frontal part of the cephalon the limb disappears under the slightly overhanging glabella. On the posterior border of the free cheeks, the marginal border and the posterior border of the cephalon are uniting to produce a short genal spine. The related parallel striae seem to converge backwardly into this spine, without reaching however its posterior end.

The glabella is moderately inflated, pear-shaped, expanded anteriorly, moderately prominent and gibbous in front, where it is distinctly overhanging the limb, bounded by deep, posteriorly constricting furrows; ornamented on the anterior side with seemingly concentric wrinkles, which are regularly parallel to the contours of the glabella. Towards the neck-furrow and on the lateral sides of the glabella this transverse wrinkling passes into a dense punctation of small granules.

There are utterly no lateral furrows to be seen, but the presence of an hardly, prominent and rudimentary (?) basal lobe on each side of the glabella indicates that the strong and deep furrows by which these basal lobes are separated from the glabella are effectively backwardly curving lateral furrows, easily to be confound with the less pronunciated dorsal furrows, which separate the basal lobes from the palpebral lobes (fig. 21). These basal lobes are nearly triangular in form and lie in the very proximity of the eyes. They are however not completely separated from the glabella. They are hardly prominent, but can easily be detected in well-preserved specimens by their distinct ornamentation, consisting of a very fine granulation, while the separating furrows are completely smoothed.

The occipital ring is broad and swollen and separated from the glabella by a deep neck furrow, which curves in its central portion towards the glabella. The neck-ring is ornamented over its whole surface with small granules, which seem to be larger and more distinct on the posterior margin. A central tubercle is always present in the midst of the most prominent part of the occipital ring.

The f r e e c h e e k s are strongly convex, triangular in form and covered on their raised portion ("genal field") with a dense punctation of small granules, except immediately under the eyes, along a narrow, band-like depression, which is completely smooth ("suboccular groove"). They are posteriorly bordered by the strongly erected and well-differentiated genal portion of the neck-segment (= posterior border of the cephalon). The f i x e d c h e e k s are very narrow on account of their limitation by the facial suture, which is the typical one of the genus *Griffithides*, showing a slight expansion between the eyes and the frontal rim.

The e y e s are crescent-shaped and relatively large, their length being somewhat more than one third the length of the glabella. They are fairly prominent and seem to be smoothed on their external surface.

The **thorax** is missing and the number of thoracic segments not known, probably 9 in number.

The **pygidium** is almost semi-circular in outline and surrounded by a broad slightly curved border, folding under the test. This border does however not resemble the horizontally extended limb of most of the *Griffithidae*; but rather rapproaches to the marginal area of *Griffithides indicus*. There is however no marginal depression to be detected, the border being distinctly marked by the deficiency of segmentation. (fig. 29).

The a x i s is moderately elevated, somewhat-larger in width than the pleural lobes and but slightly constricting posteriorly. In none of the specimens described till now the axis is reaching to the caudal end of the pygidium. It is composed of 9 or 10 coalesced segments, while the number of pleural segment is constantly 8. Through the geniculating points of the strong axial segments runs a slight depression on each side of the axis, thus differentiating the axis in a strongly segmented crest and two lateral bands with much weaker segmentation. When the shell is removed these lateral bands seem to be completely smooth, while the crest is still distinctly segmented. The crestal segments are well-differentiated and separated from one another by deep furrows. They are slightly arched backward and are distinctly reversed towards the caudal end of the pygidium. The pleural segments are geniculating in the present specimens in the dorsal furrows and become more and more distinct towards the centre of the pleural lobe, thus accentuating the convexity of this

lobe. They decrease towards the marginal border. The deep furrows separating the pleural segments abruptely end on about 2 à 3 mm. distance from the outer edge of the pygidium, thus differentiating the typical pygidial limb of *Griffithides verrucosus* (fig. 29), where the segmentation is indistinctly indicated by faint striae in the prolongation of the pleural grooves. The whole surface of the pygidium is ornamented with small granules.

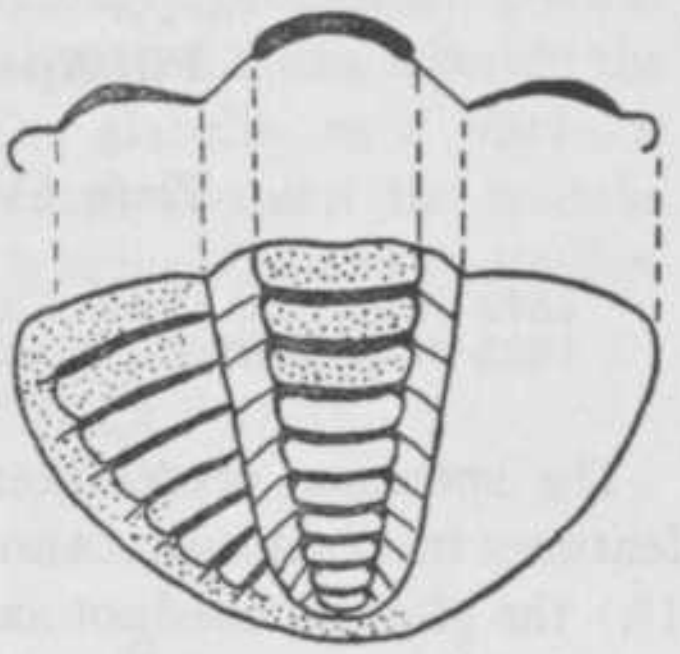


FIG. 29. Pygidium of *Griffithides verrucosus* GEMM.

Discussion. Some additional remarks have to be made to the foregoing description, mostly in explanation of the slight differences between GEMMELLARO's description and that given above.

1) t h e l o w e r c o n v e x i t y o f t h e m a r g i n a l b o r d e r o f t h e m o v a b l e c h e c k. This feature was used by TESCH as one of the typically discriminating features of *Neoproetus indicus* TESCH. He was entitled to do so, at the moment this lower convexity was only found in timorese specimens, but now that differences in this convexity have also been found in specimens from the same locality as GEMMELLARO's genotype, we must admit that the convexity of the marginal border of the free cheek and the resulting outline of the entire cephalon, is only a feature of individual significance. It should furthermore be noted that GEMMELLARO figured only lose genae and that a comparison among his figures, in this connection, is of doubtful use.
2) t h e r e l a t i v e l y l a r g e e y e s, GEMMELLARO stated that the eyes were small, but in referring their length to that of the glabella, we have a more valuable scale for comparison The eyes of *Neoproetus* were said to be large, but as a matter of fact they represent the same proportional length as those in *Griffithides verrucosus.*
3) T h e n u m b e r o f s e g m e n t s i n t h e pygidial axis, GEMMELLARO stated in his description that the axis was composed 10 coalesced segments, but he represented as *Griffithides verrucosus* a pygidium with 9 axial segments and the two

pygidia of my collection, doubtessly belonging to this species also exhibit 9 and 10 axial segments.

Phillipsia sicula Gemm.

Plate IV fig. 3; textfig. 30

1892 *Phillipsia sicula* Gemm. 1892 p. 8 Tav. I fig. 8 à 12.
1935 *Neogriffithides sicula* Gemm. (Toumansky 1935).

The specimen represented in my collection only differs in two features from Gemmellaro's holotype.

1°. the glabella does not extend to the frontal rim of the cephalon, but is separated from it by the narrow and deep marginal furrow underlying the strongly gibbous glabella and separating the well-marked limb, which is distinctly striated longitudinally. As the specimens figured in Gemmellaro (1892 Fav. I fig. 8 en 9) are but fragmental cephalons I firmly believe that the narrow band anterior to the glabella has been broken off along the deep marginal furrow. The specimen of my collection (from the same locality as Gemmellaro's) is doubtessly a better and more completely conservated one. It is therefore highly probable that the marginal limb is effectively present in *Phillipsia sicula* Gemm.

2°. the specimen described here is seemingly smooth, whilst Gemmellaro's holotype was finely granulose, u n d e r a m a g n i f i e r. By an enlargment of about 6 × the surface of my specimen appears to be r o u g h, without discernible granulation or pustulation. It is probable that this rugosity has been interpretated by Gemmellaro as a fine granulation. As such slight and questionable differences can but insufficiently justify the distinguishing of a new species or variety, I feel entitled to identify completely my specimen with Gemmellaro's holotype.

From the striking difference between the rough surface of the prominent glabella and the absolutely smoothed lateral furrows an important observation with subsequent deduction is to be made here.

The less prominent or lowered lateral appendages between the lateral furrows (fig. 30 A) (that is to say, the lateral lobes or the

segments of the glabella) are of the same structure than the strongly gibbous portion of the glabella. They are also belonging to the glabella, which is thus differentiated in a strongly prominent p e a r-s h a p e d central portion and laterally lowered areas, wherein the lateral furrows are to be recognized. The glabella, as a whole, is bounded by sinuate furrows, curving inwards at about the middle. This observation explains GEMMELLARO's determination of *Phillip-*

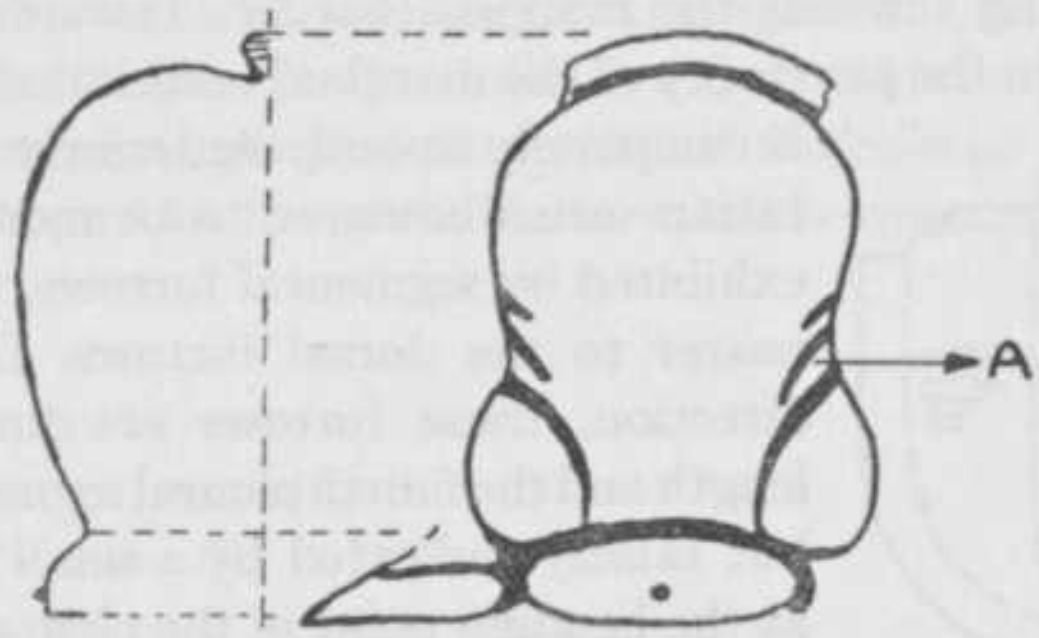


FIG. 30. Cephalon of *Phillipsia sicula* GEMM.

sia sicula, which was in complete agreement with PORTLOCK's diagnosis.

The pyriform differentiation of this phillipsid glabella is obviously caused by a secondary constriction of the glabella in backward direction and not by the backward curving of the basal and lateral furrows, as it is generally admitted for the derivation of the pyriform glabella (*Griffithides*) from the phillipsid glabella. In the interpretation given here to the morphology of the sicilean species *Phillipsia sicula* GEMM thus represents a second mode of transitional evolution from *Phillipsia* to *Griffithides*.

***Griffithides (?) juvenalis* n. sp.**

Plate II fig. 4; textfig. 31

Among the sicilean specimens of my collection an almost microscopical pygidium discovered in the Permian Fusulina-limestone of Palermo (Sicily), should be mentioned here on account of its remarkable aberrant configuration. Although it is wholly impossible to state with security its generic or specific status I feel enclined to consider it as a rather larval stage of one of the known

sicilean species. It was found together with a cephalon of *Griffithides verrucosus* GEMM, of much larger dimensions; but the rudimentary development of a distinct, horizontally outward bending marginal border prevents the complete identification with the latter. The most striking peculiarity of the present specimen is moreover the rudimentary segmentation of the pleural lobes, which is but faintly indicated by an indistinct furcation of the area, where the pleural lobe is curving towards the marginal border. Towards the dorsal furrows and in the proximity of the marginal border the pleural lobe is completely smooth. Anteriorly the segmentation seems however to be more distinctly exhibited by segmental furrows, which reach nearer to the dorsal furrows. In backward direction, these furrows are diminishing in length and the fourth pleural segment is finally but faintly indicated by a small prominence at the bending point of the pleural lobe. (The distinct segment in front of the pygidiun,- shown by fig. 4 on plate II does not belong to the pygidium, but constitutes the posterior thoracic segment). The pygidium itself is semicircular in outline. The median axis, but moderately constricting backwardly, does not reach to the posterior border of the pygidium and although fairly prominent in its posterior part, it does not overhang the marginal border. The rhachys is strongly arched and like the pleural lobe, more distinctly segmented in its anterior part. Although no nearer information can be given here, the present pygidium had to be described on account of its probable larval development, which makes it worthy of peculiar attention.

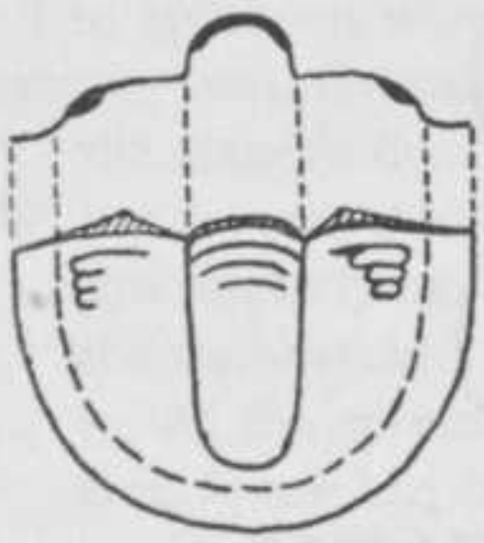


FIG. 31.
Schematic pydidium of *Griffithides* (?) *juvenalis n. sp.*

In the permo-carboniferous trilobites the evolution from the larval stage to the mature individual is an extremely complicated and intensive one, as was shown by WELLER's investigation (1935) of *Ditomopyge lansingensis* NEWELL. In the present case it would be of particular interest to know the mature individual and the transitional stages leading to it, as this could afford some nearer information not only in the evolution of the species itself, but also, in a more general way, in the still unresolved problem of the generation of the pygidial segments. The localisation and the gradually deve-

lopment of the segments in the anterior part of the present pygidium should be compared in this connection with that in closely related specimens belonging to the same evollutive series; therefore subsequent findings in the sicilean limestone with Fusulina are of considerable importance.

The significance given to the present specimen together with the impossibility to bring it to one of the known genera compelled me to press it provisionally into the genus *Griffithides*, untill nearer information should permit the definitive determination.

I therefore might propose the name of *Griffithides* (?) *juvenalis* n. sp. with regard to the probable larval development of the holotype.

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PLATES

Explanation of the Plates

Plate I.

Fig. 1*a*. Cephalon of *Phillipsia hildae* n. sp.; enlarged × 4.
Fig. 1*b*. pygidium of the same individual; enlarged × 4.
Fig. 2*a*. Cephalon of *Griffithides indicus* Tesch; enlarged × 2.
Fig. 2*b*. pygidium of *Griffithides indicus* Tesch; Forma B; enlarged × 2.
Fig. 3. pygidium of *Griffithides indicus* Tesch; Forma A; enlarged × 2.
Fig. 4. pygidium of *Griffithides indicus* Tesch; Forma C; enlarged × 2.
Fig. 5. Cephalon of *Griffithides verrucosus* Gemm; enlarged × 5.
Fig. 6. Pygidium of *Griffithides verrucosus* Gemm; enlarged × 5.

Plate II.

Fig. 1*a*. Striation of the marginal border of the cephalon of *Griffithides baungensis* n. sp.; enlarged × 2.
Fig. 1*b*. Cephalon of *Griffithides baungensis* n. sp.; enlarged × 2.
Fig. 2*a*. Cephalon of *Griffithides trigonoceps* n. sp.; enlarged × 2.
Fig. 2*b*. pygidium of the same individual; enlarged × 2.
Fig. 3*a*. Cephalon of *Griffithides gerthi* n. sp.; enlarged × 2.
Fig. 3*b*. Thorax of *Griffithides gerthi* n. sp.; enlarged × 2.
Fig. 3*c*. pygidium of *Griffithides gerthi* n. sp.; enlarged × 2.
Fig. 4. pygidium of *Griffithides* (*?*) *juvenalis* n. sp.; enlarged × 8½.

Plate III.

Fig. 1*a*. Cephalon of *Griffithides breviceps* n. sp.; enlarged × 5.
Fig. 1*b*. pygidium of the same individual; enlarged × 4½.
Fig. 2. pygidium of *Griffithides breviceps n. sp. var. axistriata nov. var.* enlarged × 4.
Fig. 3. pygidium of *Griffithides breviceps n. sp. var. axistriata nov. var.* enlarged × 5.

Plate IV.

Fig. 1*a*. Cephalon of *Griffithides brevicauda* n. sp.; enlarged × 4.
Fig. 1*b*. pygidium of *Griffithides brevicauda* n. sp.; enlarged × 4.
Fig. 2*a*. cephalon of *Griffithides teschi* n. sp.; enlarged × 2.
Fig. 2*b*. pygidium of *Griffithides teschi* n. sp., enlarged × 2.
Fig. 3. Glabella of *Phillipsia sicula* Gemm.; enlarged × 8.
Fig. 4. Pygidium of *Griffithides* (*Pseudophillipsia*) *timorensis n. sp.* enlarged × 2.

FIG. 1*a*.

FIG. 1*b*.

FIG. 3.

FIG. 5.

FIG. 2*a*.

FIG. 2*b*.

FIG. 4.

FIG. 6.

FIG. 1*a*.

FIG. 1*b*.

FIG. 2*a*.

FIG. 3*a*.

FIG. 2*b*.

FIG. 3*b*.

FIG. 4.

FIG. 3*c*.

FIG. 1*a*.

FIG. 1*b*.

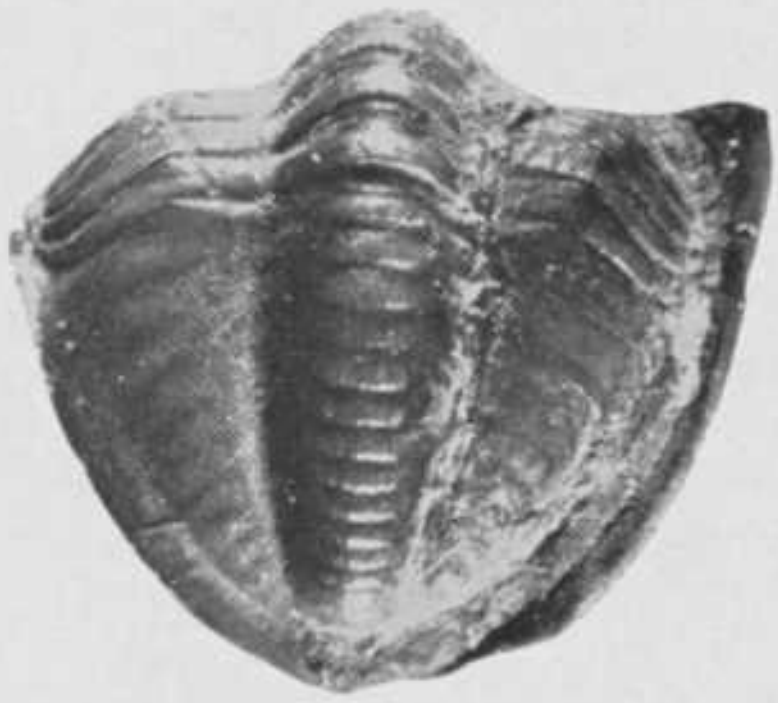

FIG. 2.

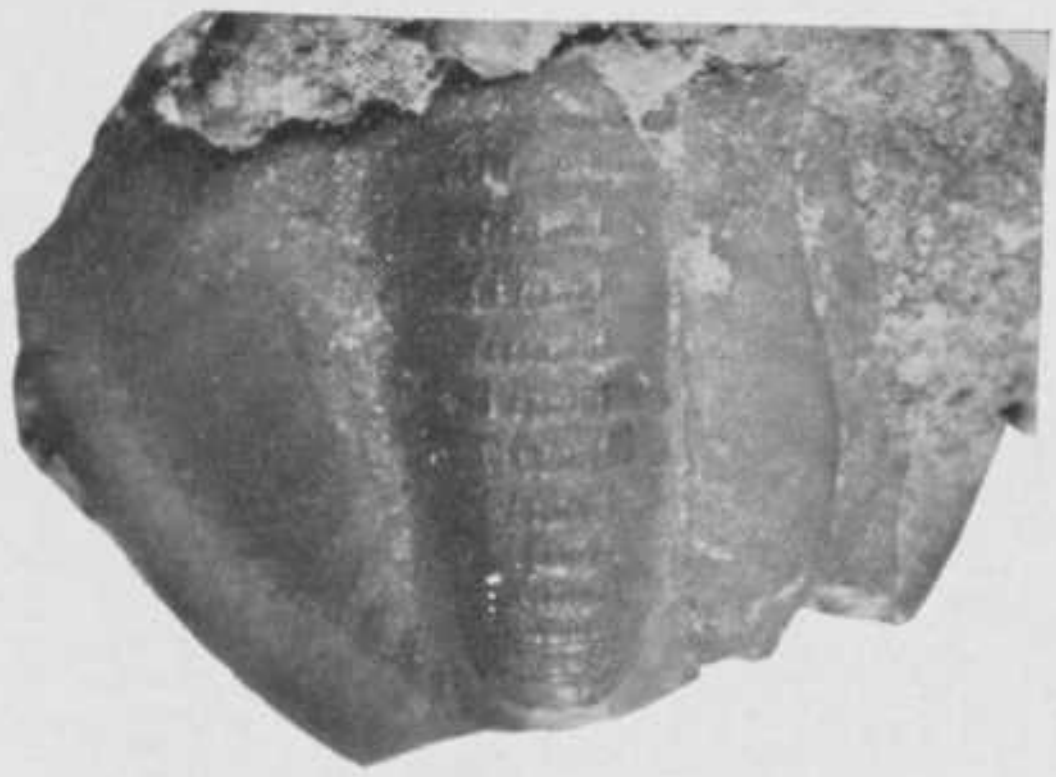

FIG. 3.

PLATE IV

FIG. 1*a*.

FIG. 1*b*.

FIG. 3.

FIG. 2*a*.

FIG. 2*b*.

FIG. 4.

STELLINGEN.

I.

Het ontbreken van diepzee-afzettingen in de sedimentaire serie is geen bewijs voor de bestendigheid der abyssale gebieden.

II.

De theorie van WALTHER betreffende het ontstaan der zout-afzettingen van Stassfurt is in strijd met de geologische waarnemingen en met de wetten van VAN 'T HOFF.

III.

De dioriet van den Massif du Canigou, in de Oostelijke Pyreneeën, is niet ontstaan door endogene metamorphose van den graniet, zooals door MENGEL ten onrechte wordt verondersteld.

IV.

Het bestaan van symmetrie-assen in de oppervlakte-structuren der aardkorst, zooals door FOURMARIER worden voorgestaan, zou elke mogelijkheid van horizontale schollen-verplaatsingen uitsluiten.

V.

Het theoretische peneplain-stadium kan bereikt worden, niettegenstaande de isostatische compensatie.

VI.

De fossiele dwergfaunae kunnen door geen enkele der bestaande theorieën verklaard worden.

VII.

LACHMANN's theorie der autoplaste-plooiïng is niet in strijd met de leer der epeirophorese.

VIII.

Elke beschrijving van een waargenomen feit dient, door den waarnemer zelf, aangevuld te worden met een interpretatie van het waargenomene.