

THE MIDDLE JURASSIC AMMONITE GENUS *OECOTRAUSTES* WAAGEN

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I. INTRODUCTION

The widely distributed Middle Jurassic Oppeliid genus *Oecotraustes* Waagen, 1869, has been recently discussed by several authors, but, in my opinion, a final classification has still not yet been reached. The genus will be monographed by me, but the monograph will be delayed while further material is collected to establish its full subgeneric and specific contents and also the exact stratigraphical range of all species, which will make the drawing of phylogenetic relationships as accurate as possible. The aim of the present notes is, without going into discussion of previous systematics, to describe shortly all known species, incl. the new ones, giving for each one a comparatively full synonymy and reproducing photographically almost all type specimens. Thus, the considerable number of Middle Jurassic ammonite workers will have a means of determining the *Oecotraustes* of their own collection exactly. Let me mention that about 80% of the specimens figured up to the present time (with the exception of the type specimens) have been published under wrong names. This paper aims at avoiding further misidentification. Thus, the forthcoming monograph of the genus will be made easier.

I feel that the large revision of the *Oecotraustes*, on which I have been working for the last 7 years, could not be done without the help of friends. First of all, I would like to express my great thanks to my colleague and friend Mr. H. S. Torrens of the University, Leicester (England), who several times sent me *Oecotraustes* of his own collection, or arranged for casts or originals kept in various natural history museums in England to be sent to me; he sent me also rare papers photographically reproduced, that in some way involve the genus and gave me valuable information about the revised stratigraphical range of the English *Oecotraustes*; further, he kindly read the manuscript of the present paper, improving my imperfect English. I deeply appreciate Mr. Torrens' help of various kinds and am, indeed, very grateful to him. I troubled Dr. R. Enay, Dr. S. Elmi and Dr. Ch. Mangold of the University, Lyon (France), several times in connection with the originals of Lissajous' posthumous work (1923) and they kindly sent me casts of all the *Oecotraustes* published in the important Bathonian monograph of this author. Dr. B. Ziegler of the University, Zürich (Switzerland), now in the Technical University, Berlin (Germany), kindly arranged for casts of the type series of Arkell's two Schwandorf species to be sent to me, and also sent me a collection of other 47 Schwandorf *Oecotraustes* and Oppeliid nuclei, at least a part of which had never been seen by Arkell. The late Prof. Dr. A. Bentz and Dr. R. Jordan of Bundesanstalt für Bodenforschung, Hannover (Germany), kindly sent me various originals of Westermann's important Bathonian ammonite monograph (1958), incl. the *Oecotraustes* of this author. Dr. E. Basse de Menorval of the Muséum National d'Histoire Naturelle, Paris (France), spent much of her valuable time in making inquiries in several natural history museums in France about the whereabouts of some ammonite originals,

incl. the *Oecotraustes*, published in several of de Grossouvre's Bathonian papers, and kindly sent me casts and photographs of the specimens of this genus published in the work of 1888 by this author. I am also most thankful to Dr. J. Remane of Georg-August University, Göttingen (Germany), who loaned me originals of *Oecotraustes* figured in Roemer's dissertation (1911). I wish to thank Dr. F. W. Anderson, Dr. R. Casey and Dr. H. Ivimey Cook of the Geological Survey & Museum, London (England), Dr. C. L. Forbes of the Sedgwick Museum, Cambridge (England) and Mr. D. A. Hallam of Taunton Castle Museum (England), who kindly sent me casts and photographs of various English *Oecotraustes*. Thanks to Dr. K.-W. Barthel and Dr. P. Wellnhofer of Bayerische Staatssammlung für Paläontologie und historische Geologie, München (Germany), I have before me a cast of the famous *Oecotraustes genicularis* and also casts of some of Waagen's (1869) and Westermann's (1958) other *Oecotraustes*. I am also very grateful to Gen. M. Collignon, Membre Correspondant de l'Académie des Sciences de France, Isère (France), who loaned me an original of *Oecotraustes* from Madagascar, published by him (1958). Also Dr. A. Zeiss of the University, Erlangen (Germany), kindly sent me casts of the three *Oecotraustes*, published by P. Dorn (1927). My friend Dr. D. Patruşius of Comitetul Geologic, Bucurest (Rumania), kindly sent me his large Oppeliid collection which contains some specimens of this genus. Besides, during my visits to Poland (1951) and Russia (1964) Prof. P. Passendorfer and Prof. H. Makowski, both from Warsaw University and Dr. J. Znosko from the Institute Geologiczny, Warsaw (Poland), as well as Prof. G. Ya. Krimholz and Dr. L. V. Sibirjakova from Leningrad University, Dr. T. A. Gassanov and Dr. M. R. Abdulkassumzade of the Geological Institute AzAN, Baku (Azerbaijan, USSR), and Dr. N. G. Khimshiashvili from the Palaeobiological Institute GrAN, Tbilisi (Georgia, USSR), showed me various *Oecotraustes* of their collections, allowing me to make casts of them or loaning me several originals. Recently, thanks to Mr. H. S. Torrens, I was allowed to see casts of 11 *Oecotraustes* of Brig. G. Bomford's collection and also two others of Abbé R. Mouterde's collection.

Some problems about *Oecotraustes* were discussed with Dr. J. H. Callomon of the University College, London (England), Prof. D. T. Donovan of the University, Hull (England), Dr. G. Westermann of McMaster University, Hamilton (Ontario, Canada) and Dr. B. Ziegler of Technischen Universität, Berlin (Germany). Valuable information about some Oppeliids published by Parona (1895) was received from Dr. C. Sturani of Istituto di Geologia, Paleontologia e Geografia fisica, Torino (Italy).

I greatly appreciate this help of various kinds from all above mentioned colleagues and friends and am, indeed, very grateful to everyone of them.

In the future I would also be very grateful if collectors of new *Oecotraustes*, accurately localised, could send them to me or at least casts of them; this would be of considerable help when monographing the genus in the future.

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The present revision of the genus *Oecotraustes* is based on about 500 specimens or casts from the Middle Jurassic (but mainly from the Bathonian) of almost the whole of Europe. The material is very well preserved and more than a half of the collection, that I have investigated, is represented by complete specimens, with body chambers and the base or the whole of the lateral lappets preserved. The whereabouts of every figured specimen is stated in the paper.

II. STRATIGRAPHICAL SCHEME ADOPTED

Oecotraustes are known to range from the Upper Bajocian to the Middle Callovian, but the accurate stratigraphical distribution of almost all representatives of the genus is not satisfactorily known. Further investigation in this respect would be a wonderful addition to this paper. The stratigraph-

Zonal scheme adopted in the present paper

| Stages | Substages | Zones | |
|-----------|------------------|-------------------------|------------------------|
| | | N. W. European Province | Mediterranean Province |
| Callovian | Middle Callovian | Coronatum | Middle Callovian |
| | | Jason | |
| | Lower Callovian | Calloviense | Lower Callovian |
| | | Koenigi | |
| | | Macrocephalus | |
| Bathonian | Upper Bathonian | Discus | |
| | | Aspidoides | |
| | | "Retrocostatum" | |
| | Middle Bathonian | Morrisi | |
| | | Subcontractus | |
| | | Progracilis | |
| | Lower Bathonian | Fallax | |
| | | Zigzag | |
| Bajocian | Upper Bajocian | Parkinsoni | |
| | | Garantiana | |
| | | Subfurcatum | |

ical range of these species, as stated in the present notes, is according to our present knowledge, but it might be modified for every species under discussion by further detailed investigations, mainly of uncondensed sections.

The zonal scheme of the Upper Bajocian Substage, accepted and followed in the present paper, is the usual and well known one (see Arkell, 1956a). The zonal scheme of the Bathonian Stage is that of Arkell (1951a—1959) and Torrens (1965); the latter, being revised and more detailed, seems to me to be the better one and this latter scheme is accepted and followed in the present paper. However, Torrens' Zigzag Zone still has not a well defined content, because, as he kindly wrote to me, further investigations are needed to establish whether the level of *Oecotraustes costiger* and *Oecotraustes nodifer* belongs to the very lowest Bathonian, thus being its first horizon [as Arkell (1951a—1959) who put it in the Zigzag Zone], or whether it belongs to the Upper Bajocian; it is, however, certainly below the horizon of *Parkinsonia convergens* and *Parkinsonia pachypleura*. For deciding such question a "Rule of the well fixed lower boundary of units" was proposed (see Ager, 1963; Callomon, 1965), the application of which will be very useful in this case. I could not avoid mentioning the Zigzag Zone problem as it concerns *Oecotraustes*, but I cannot be of help in solving this problem, because I am not working in the type areas of either Bajocian or Bathonian Stages. I am, therefore, leaving this problem entirely in Torrens' hands. However, provisionally, until he takes a final decision, he advised me to put the level of *Oecotraustes costiger* and *Oecotraustes nodifer* in the Bajocian Stage as its final horizon. Further, because of theoretical reasons which I am not discussing here (see J. Stephanov, 1966 — Section III) I am prone to consider the Fallax Zone as a separate zone of the Lower Bathonian. Upward the zonal scheme of the Bathonian is entirely the same as that of Torrens (1965) with an exception about his "Unnamed Zone" only; to avoid misunderstandings, here I shall call this zone provisionally (until Torrens selects its final name) the "Retrocostatum" Zone, putting "Retrocostatum" in inverted commas, thus indicating that the name is not the final one. The zonal scheme of the Lower and Middle (and also Upper) Callovian ought to be different in N. W. European and Mediterranean Provinces (see Nachev, Sapunov & J. Stephanov, 1963; Howarth & J. Stephanov, 1965). However, Callovian zones are realised and arranged in a scheme in the first province only, while a zonal scheme for this stage still has to be elaborated in the second province. Consequently, Callovian zones are accepted and followed in this paper according to Arkell (1956a) and Callomon (1964) for the N. W. European Province only. The Mediterranean Callovian is divided into substages (for more details about the definition of the Mediterranean Callovian substages see Howarth & J. Stephanov, 1965).

Thus the final appearance of the zonal scheme for the Upper Bajocian, Bathonian and Lower and Middle Callovian (without the subzones), as accepted in this paper, is that shown on Table I.

III. THE GENUS AND ITS SUBGENERA

The genus *Oecotraustes* are small, keeled, more or less elliptically coiled Oppeliids with lappets, generally having sygmoidal, falcate or angular ribbing; outer ribs often being surmounted by a small nodule, node, or

clavus. The genus appeared most probably early in the Upper Bajocian or even in the late Middle Bajocian, and became extinct in the Middle Callovian, having its acme during the Bathonian Age. The ancestral genus is still unknown but it seems to me that the earliest *Oecotraustes* show resemblance to the genus *Oppelia* Waagen, 1869. No descendants of *Oecotraustes* have been established till now and probably the genus died out without giving rise to any other genera.

The subgenera. In this paper the genus *Oecotraustes* comprises several subgenera: 1. the nominate subgenus; 2. subgenus *Paroecotraustes* Spath, 1928; 3. subgenus *Pseudoecotraustes* subgen. nov. (Khimshiashvilli & J. Stephanov) and 4. subgenus *Thraxites* subgen. nov. (J. Stephanov).

The nominate subgenus embraces species with sigmoidal or even falcate ribbing, the inner ribs being often very slight or reduced to striae, or even absent. In this paper it includes 7 species. It is the earliest stratigraphically and appeared in the Upper (or even in the Middle) Bajocian, continuing up to the early Upper Bathonian, but its acme is from Parkinsoni to Zigsag Zones.

The subgenus *Paroecotraustes* encompasses species that have strongly angular ribbing; the inner ribs, as well as the outer ribs, are generally well expressed and, in some species, even strong. It includes 15 species in this paper. This is the most common subgenus having representatives which are widely distributed in the whole European region and also far from Europe. *Paroecotraustes* appeared in the Lower Bathonian and the ancestral species, although unknown, is to be found among the group of *Oecotraustes costiger*. The subgenus suddenly became extinct in the Upper Bathonian (after the Aspidoides Zone), having its acme from Subcontractus to Aspidoides Zones.

The subgenus *Pseudoecotraustes* is known only by one species which, instead of possessing ventrolateral nodes or clavi, has very characteristic bifurcations of the outer ribs; these branches cross the keeled venter without being interrupted or diminished, thus forming small chevrons. The stratigraphical position and the age of the strata that yielded the sole representative of this subgenus are not accurately established, but it seems that this is an Upper Bathonian subgenus, which is a derivative of *Oecotraustes* (*Paroecotraustes*) *paradoxus*.

The subgenus *Thraxites* encompasses species that have inner whorls ornamented with slightly sigmoidal or falcate ribs, but on the body chamber the outer ribs suddenly become widely spaced and strong with exaggerated ventrolateral clavi. This is a small subgenus which includes 4 species in this paper. It appeared in the early Upper Bathonian and is a derivative of the Lower Bathonian *Oecotraustes nodifer* but the links between the latter and the earliest *Thraxites* still remain unknown. The subgenus disappeared in the Middle Callovian, having its acme during the Lower Callovian.

Comparisons. *Oecotraustes* are relatively easily determined fossils. However, I would still recommend that only complete specimens be named, though a worker with some experience might recognize a species from fragmentary specimens, too.

Being distributed during the Upper Bajocian — Middle Callovian, the genus *Oecotraustes* is contemporary or partly overlaps with a number of other Oppeliid genera with which it could be confused. Thus the most fre-

quent confusions arise when a collection contains specimens of both *Oecotraustes* and *Oxycerites*. To distinguish adult and complete individuals of small *Oecotraustes* from adult and complete individuals of large *Oxycerites*, and to name these with specific names is a comparatively easy task, but the matter becomes very difficult when nuclei are to be distinguished. In my

opinion, at present such nuclei are impossible to distinguish and in order to avoid further confusions, I would recommend that authors refrain from naming nuclei or otherwise immature individuals which are thought to be *Oecotraustes* or *Oxycerites*. I would emphasize that nuclei of *Oppelia* and *Oecotraustes* are also indistinguishable.

A further common mistake is the confusion between *Oecotraustes* and *Hecticoceras* or *Otoxyites* (and its subgenus *Prohecticoceras*) even when adult specimens are available. However, *Oecotraustes* are always elliptically coiled or even slightly scaphitoid, while the latter, being *Hecticoceratinae*, are both quite regularly coiled. Concerning *Hecticoceras* I would also emphasize that the latter are confined to Callovian to early Oxfordian, while *Oecotraustes* (*Paroecotraustes*), with which they have been often confused, are strictly Bathonian fossils.

Rarely *Cadomoceras* could be mistaken for some early *Oecotraustes*,

but these two genera are almost entirely stratigraphically separate and, besides, *Cadomoceras* have no ornamentation on their inner whorls.

Horioceras could be mistaken for some *Oecotraustes* (*Thraxites*), but these genera have different stratigraphical distributions which are quite separate and, besides, *Horioceras* like all *Distichoceratinae* are regularly coiled. *Oecotraustes* (*Thraxites*), on the other hand, are always elliptically coiled or even slightly scaphitoid.

Dimorphism in the genus. Ever since Waagen (1869) *Oecotraustes* have often been the subject of discussions in connection with the sexual dimorphism in ammonites.

But can sexual dimorphism in this extinct group be proved? Authors of recent papers (Callomon, 1963; Makowski, 1963; Westermann, 1964) try to prove sexual dimorphism in ammonites, but I think that we still cannot establish with certainty the sex of the zooid of any given fossil ammonite shell. The arrangement, therefore, of individuals (or taxa of higher rank) into sexually dimorphic pairs remains intuitive in the present state of palaeontological science and is purely a matter of subjective interpretation. Of course, the above does not lessen the need for scientific research in this direction and as such is to be welcomed, but we must be real-

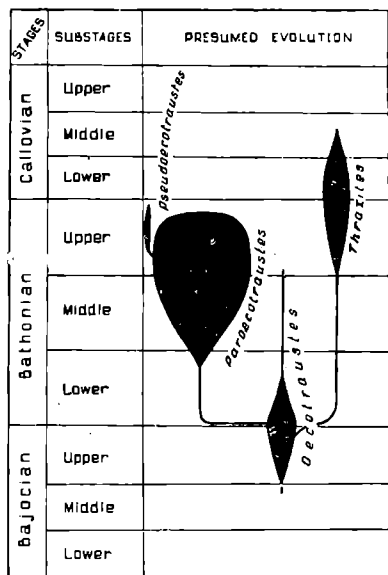


Fig. 1. Presumed phylogeny of the subgenera of *Oecotraustes*

ists in recognizing that sexual dimorphism in ammonites, at least for the present time, must remain a hypothesis.

Let me mention, that I agree in advance with my opponents that the considerations given below about sexual dimorphism within the genus *Oecotraustes* are also an interpretation. But I am still tempted to note my observations in this field. Thus, it is remarkable that species of *Oecotraustes* of which I have a considerable number of specimens at my disposal show a clear dimorphism. I am inclined to interpret this as a sexual dimorphism. However, I am thus in contradiction with a number of former and more recent authors on this subject, who are prone to see sexual dimorphism between genera, which are generally regarded as separate. One of the grounds on which such authors couple genera in sexually dimorphic pairs is that some microconchs possess lappets when adult, while some macroconchs have a simple aperture. The microconchs were interpreted as males and the macroconchs as female. I am not discussing here the importance of the different types of aperture as sexual indicators, but I would only point out that I am prone to interpret these as features of generic rank. Thus, I am inclined to see sexual dimorphism, let me repeat again, within the microconchs and macroconchs themselves, i. e. within what are generally recognized as genera, and more exactly within one species of a given genus, and not between genera which are recognized as separate. In this respect I am probably close to the ideas of B. Ziegler (1958), who considered that the microconch genus *Glochiceras*, all of whose representatives possess lappets, encompasses species to which individuals of different sex belong.

This dimorphism within different species of the genus *Oecotraustes*, mentioned above, is seen in a number of species of which I possess enough individuals. In these one is able to distinguish larger adult specimens with lappets that are more regularly coiled and smaller adult specimens with lappets that are more scaphitoid (see text-fig. A). I am retaining here the terms microconch (*m*) and macroconch (*M*) for these two groups in each species. The examples of micro- and macroconch pairs that are given on the text-fig. A are from the same beds; I am prone to interpret these as belonging to the same populations.

I would emphasize here that there are all intermediate forms in morphology and size between the micro- and macroconchs under consideration. I do not consider this fact to be in contradiction to the hypothesis of sexual dimorphism in ammonites, because I can find no grounds for regarding the lack of morphologically intermediate adult forms as a requirement in coupling individuals into sexually dimorphic pairs (see Makowski, 1963, p. 12 — his second condition). In fact only the soft ammonite zooids, or more exactly, only their sex organs were morphologically distinct. It might be expected that all other features and characteristics of both soft zooid and shell might show morphological transitions.

The above is briefly my point of view about the hypothesis of sexual dimorphism in ammonites and in particular in the Oppeliidae. *Oecotraustes* are an example of this family that illustrates my conceptions well. Further discussion of the sexual dimorphism within each particular species of *Oecotraustes*, new evidence, diagrams, etc., as well as a discussion of the spe-



1M



1m



2M



2m



3M



3m



4M



4m

cies concept in ammonite palaeontology as based on the hypothesis of sexual dimorphism in ammonites and the interconnected problems of ammonite taxonomy will be delayed until the genus is monographed.

IV. SYSTEMATIC DESCRIPTIONS

Superfamily **HAPLOCERATACEAE** ZITTEL, 1884

Family **OPPELIIDAE** BONARELLI, 1894

Subfamily **OPPELIINAE** BONARELLI, 1894

Genus ***Oecotraustes*** Waagen 1869, p. 251(73)

Nomenclature. Type species by subsequent designation (see Munier-Chalmas, 1892, p. CLXXI) is the species *Oecotraustes genicularis* Waagen [see 1869, p. 251(73)] originally included in this genus.

Diagnosis. Small ammonites (± 20 –60 mm. when adult), more or less elliptically coiled, with two lateral lappets and an extremely short ventral lappet. Aperture slightly contracted on the venter and lateral walls, just before the lappets. Venter usually smooth (but rarely ribbed); narrow and fastigate on the phragmocone, it gradually becomes slightly wider and more or less rounded on the body chamber. Umbilicus highly variable from ± 0.15 to ± 0.40 . Umbilical walls vertical or steep, low to moderately high. Umbilical edge varies from sharp in species with narrow umbilicus to extremely rounded in species with wide umbilicus. Lateral walls generally flat or very slightly inflated. Whorl section higher than wide. Ornamentation ranges from striae-like to strong and consists of sygmoidal, falcate, or angular ribs, often surmounted by ventrolateral nodules, nodes or clavi, or rarely, by bifurcations that cross the keeled venter. Only species with angular ribs possess a spiral groove. Sexual dimorphism recognized in some species, the microconchs being more elliptically coiled and the macroconchs less elliptically coiled. Upper Bajocian — Middle Callovian.

Synonyms. Objective: *Oekotraustes* Waagen, 1869, p. 251(73) is a senior objective synonym under ICZN opinion 324 [see Arts. 23 and 67 (i) (ii)]. Subjective: *Nodiferites* Westermann, 1958, p. 36, with type species by original designation *Oecotraustes nodifer* S. Buckman. The status of *Oppelina* S. Buckman, 1926 (TA, VI, pl. DCLXX), needs further clarification.

Text-fig. A. Presumed sexually dimorphic pairs within 4 species of *Oecotraustes*: 1M and 1m — *Oecotraustes* (*Paroecotraustes*) *maubeugei* sp. nov. from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. 2M and 2m — *Oecotraustes* (*Paroecotraustes*) *waageni* J. Stephanov from the Aspidoides Schichten (Aspidoides or "Retrocostatum" Zones) near Lechstedt (Hildesheim), Lower Saxony, Germany. 3M and 3m — *Oecotraustes* (*Paroecotraustes*) *splendens* Arkell from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. 4M and 4m — *Oecotraustes* (*Paroecotraustes*) *formosus* Arkell from Aspidoides Beds (condensed Subcontractus — Morrisi Zones) near Holz-Berg (Schwandorf), Bavaria, Germany.

Nominate subgenus **Oecotraustes** Waagen, 1869, p. 251(73)

For the nomenclature and synonymy of the nominate subgenus see under the genus above.

Diagnosis. Small ammonites ($\pm 25-50$ mm. when adult) with variable umbilicus from ± 0.20 to ± 0.30 . Venter fastigate and smooth. Ribbing sigmoidal or falcate. Inner part of the ribs are often striae-like, but can also be strong. Outer part of the ribs well differentiated, often with ventrolateral nodules or nodes. No spiral groove. Sexual dimorphism as in the genus. Upper Bajocian — Upper Bathonian.

Comparisons. *Paroecotraustes* have angular ribbing with a more or less distinct spiral groove. *Pseudoecotraustes* have bifurcating ribs on the ventrolateral edge which cross the venter forming small chevrons. *Thraxites* have dense sigmoidal or falcate ribs on the phragmocone which on the body chamber become more widely spaced with exaggerated ventrolateral clavi.

***Oecotraustes (Oecotraustes) genicularis* Waagen**

Pl. I, fig. 1

869. *Oecotraustes genicularis* Waagen, p. 227(49), pl. XX(5), figs. 4 a, b, c (lectotype designated by Arkell, 1951b, p. 7).
non 1919. *Oekotraustes genicularis* Waagen; de Grossouvre, p. 408, pl. XIV, fig. 3 [= *O. (O.) bomfordi*].
1951c. *Oecotraustes genicularis* Waagen; Arkell, text-fig. 13, no. 4 (refiguring of the lectotype).
non 1956. *Oekotraustes genicularis* Waag.; Sachariewa-Kowatschewa, p. 255 [badly preserved *O. (O.) nodifer*].
1958. *Oecotraustes (Oecotraustes) genicularis* Waagen; Westermann, p. 35, pl. 1, figs. 1a, b (refiguring of the lectotype).
non 1964. *Oecotraustes genicularis* Waag.; Sturani, p. 26, pl. IV, fig. 8 (=indeterminable Oppeliid nucleus).

Type. The lectotype was designated by Arkell (1951b, p. 7) and is the specimen figured by Waagen [1869, pl. XX (5), fig. 4]. In the same year Arkell (1951c, p. 53) wrongly attributed the lectotype designation of this species to Munier-Chalmas (1892, p. CLXXI), who never made this action. On the other hand, Westermann's statement (1958, p. 35; see also the explanation of pl. 1, fig 1) that this specimen is the holotype is also misleading, because Waagen never designated a type specimen and his species was founded on 6 specimens. The lectotype was found at Sully near Bayeux (Normandy), France, in Middle or Upper Bajocian sediments (but see the discussion under "Distribution" below). Dimensions of the lectotype as measured on a cast: max. diam. 26 mm. (aperture is not preserved); at 20 mm.: 8.5 mm. (0.42), 5.4 mm. (0.27), 5.6 mm. (0.28); at 25 mm.: 11.5 mm. (0.46), 7.0 mm. (0.28), 8.0 mm. (0.32). The lectotype is kept in the Bayerische Staatssammlung für Paläontologie und historische Geologie München (Coll. Mü. AS I 521).

Description. A rare species which is small and very slightly elliptically coiled. According to Waagen and Westermann (see synonymy) the ribbing appears at a rather early stage of the development of the conch. Inner half of the lateral walls is entirely smooth and no striae, such as are shown in Waagen's illustration [1869, pl. XX(5), fig. 4a], can be seen on the cast of the lectotype. Outer ribs are radial or slightly rursiradiate,

very dense, thin and faintly arched. An extremely slight nodule-like inflation surmounts every rib, but disappears towards the aperture. The umbilicus is moderately open; the umbilical walls are very low and vertical; the umbilical edge is extremely rounded. The venter is moderately wide and keeled but the keel fades towards the aperture.

Comparisons. This is a well differentiated species. *O. (O.) westermanni* is similar but is considerably larger and has short outer ribs. The Lower Bathonian *O. (O.) bomfordi* is slightly larger and has a very small umbilicus. The Upper Bathonian *O. (O.) bakalovi* is strongly coiled elliptically and is even scaphitoid so that cannot be mistaken for *O. (O.) genicularis*.

Distribution. According to Waagen and Westermann (see synonymy) the species occurs in the Humphriesianum or Subfurcatum Zones, but more recent revisions of the fauna from the type locality (Sully, near Bayeux, Normandy), France, showed that the age of the strata, yielded the lectotype and four of the paralectotypes of *O. (O.) genicularis* is to be considered as a condensed mixture of Garantiana and Subfurcatum Zones (de Grossouvre, 1919, p. 347 — "le niveau 1°"; Arkell, 1956a, p. 50 — layer b; de Grossouvre's and also Arkell's mentioning of this species from higher horizons seems to be based on misidentifications). On the other hand Rioult (1964, p. 246) mentioned this species as from the Parkinsoni Zone which suggests that this question needs further investigation. The fifth paralectotype is from Le Mesnil Louvigny near Caen (Normandy), France.

***Oecotraustes (Oecotraustes) westermanni* sp. nov.**

Pl. I, fig. 4

1958. *Oecotraustes* n. sp.; Westermann, p. 35, pl. 1, figs. 4a, b (only).

Type. The species is named after the German palaeontologist G. Westermann. The holotype (pl. I, fig. 4) was found in early Upper Bajocian sediments in the section "Hontoria II" near Burgos, Spain. Dimensions of the holotype measured on a cast: max. diam. 42 mm. (the aperture is not preserved); at 40 mm.: 16.0 mm. (0.40), 9.0 mm. (0.22), 11.5 mm. (0.29). Type series — 1 Spanish specimen. The holotype is kept in the Museum at the Niedersächsisches Landesamt für Bodenforschung, Hannover (Coll. Hann. b301).

Description. A large, very slightly elliptically coiled species which is septate to 30 mm. The ornamentation is very dense. Inner ribs absent well-spaced, wide and low rib-like inflations exist, however, and these are radial or slightly prorsiradiate. Outer ribs are slightly rursiradiate and unequal, very dense, thin, short and with a high relief only at the ventrolateral edge where each is surmounted by a small nodule; the nodule gradually disappears towards the aperture. The umbilicus is moderately open, and the umbilical walls are very low and vertical, the umbilical edge being well rounded. The venter is narrow and keeled, but the keel diminishes slightly towards the aperture.

Comparisons. There are no close species for which *O. (O.) westermanni* could be mistaken. *O. (O.) genicularis* is a small species whose inner part of the lateral walls is entirely smooth, whilst the outer ribs are

still denser and not so short as in *O. (O.) westermanni*. The Lower Bathonian *O. (O.) bomfordi* has a much smaller umbilicus and a sharp umbilical edge, as well as ribbing of another style.

Westermann's two other Upper Bajocian specimens (1958, pl. 1, figs. 2 and 3) are nuclei and, therefore, specifically undeterminable.

Distribution. Early Upper Bajocian species. For details of the locality and age of the holotype, the sole known species, see under "Type" above.

Oecotraustes (Oecotraustes) costiger S. Buckman

Pl. I, figs. 5—7

1888. *Oecotraustes conjungens* (K. Mayer); S. Buckman, pl. XX, figs. 15—17 [non figs. 13—14=*O. (O.) nodifer*].

1905. *Oecotraustes costiger* S. Buckman, p. CXCIV, figs. 190a, b.

1951c. *Oecotraustes (Oecotraustes) costiger* S. Buckman; Arkell, p. 67, pl. VII, figs. 3—6 (fig. 6 is the lectotype refigured).

1959. *Oecotraustes (Paroecotraustes) formosus* Arkell; Sapunov & Nachev, p. 60, pl. VI, fig. 8 (only).

Type. The lectotype, designated by Arkell (1951c, p. 67), was figured by S. Buckman (1888, pl. XX, figs. 15 and 16). It was found in the lower part of the Crackmire Limestones (topmost Upper Bajocian, Parkinsoni Zone, Bomfordi Subzone), Bradford Abbas (Dorset), England. Dimensions of the lectotype as shown by the cast: max. diam. 50 mm. (the aperture is not preserved); at 37 mm.: 18.0 mm. (0.49), 10.0 mm. (0.27), 9.5 mm. (0.26); at 47 mm.: 21.0 mm. (0.44), 12.5 mm. (0.27), 12.0 mm. (0.26). Type series — 2 specimens. The lectotype is kept in the Sedgwick Museum, the University, Cambridge (SM. J6418).

Description. This is the largest *Oecotraustes (Oecotraustes)* yet known. Markedly elliptically coiled, it shows a rough ornamentation that appears early on the inner whorls. The inner ribs are prorsiradiate, thin and dense; the outer ribs are rursiradiate, slightly arched and also dense, each one being surmounted, on the ventrolateral edge, by a small node. The nodes, however, disappear towards the aperture. There is a spiral groove which is more distinct on the paralectotype. The umbilicus is moderately open and is surmounted by low, vertical umbilical walls and a strongly rounded umbilical edge. The venter is moderately wide and keeled, but the keel becomes weaker at the aperture, the venter becoming blunt and rounded here.

Comparisons. There is no species with which *O. (O.) costiger* could be confused, but the angular ribbing and feeble spiral groove resemble characters in the subgenus *Oecotraustes (Paroecotraustes)*.

Distribution. Topmost Upper Bajocian (Parkinsoni Zone, Bomfordi Subzone). For the locality and age of the lectotype and paralectotype see under "Type" above. According to Arkell (1951c, p. 67) several specimens from Brig. Bomford's collection were found in the Zigzag Bed (Zigzag Zone) at Burton Bradstock cliff (Dorset), England. Now thanks to Brig. Bomford and Mr. H. S. Torrens I have been sent casts of several of these and can certainly confirm that none of those I have seen belong to this species (Bomford Coll. nos. 3875 and 3877, mentioned by Arkell, 1951 c, p. 67). However, there is another English specimen which is a typical *O. (O.) costiger* (see pl. I, fig. 5 of this paper); it was recently collect-

ed by Mr. N. S. Torrens in a locality in Shipton Gorge (Dorset), England, in the Bomfordi Subzone ("Schloenbachi" Subzone of English authors) of the Parkinsoni Zone. There is a further specimen (Brig. Bomford Coll. no. 7508) which must be from the same horizon; it was found in the Stoney Head quarry (Dorset), England. The Bulgarian specimen (Sapunov & Nachev, 1959) was found in unzoned sediments originally thought to be of Middle Bathonian age; but this may have been an error, for the exact position of this specimen is unknown in the section.

***Oecotraustes (Oecotraustes) nodifer* S. Buckman**

Pl. II, figs. 3—4

1888. *Oecotraustes conjungens* (K. Mayer); S. Buckman, pl. XX, figs. 13—14 [non figs. 15—17=*O. (O.) costiger*].
1905. *Oecotraustes nodifer* S. Buckman, p. CXCv, figs. 191a, b.
non 1923. *Oecotraustes nodifer* S. S. Buckman; Lissajous, p. 125, pl. XXVI, figs. 13, 13a (= *Oecotraustes nucleus*).
1951c. *Oecotraustes nodifer* S. Buckman; Arkell, p. 68, pl. VII, figs. 7 and 8a, b (holotype refigured).
1959. *Oecotraustes nodifer* Buckman; Sapunov & Nachev, p. 60, pl. VI, fig. 9.
non 1961a. *Oecotraustes nodifer* S. Buckman; J. Stephanov, p. 346, pl II, figs. 5a, b (= *Oecotraustes* indet.).
non 1963. *Oecotraustes nodifer* Buckman; Krimholz & Stankevich, p. 113, the plate, fig. 8 (= subgenus & sp. nov. of *Cadomoceras* Munier — Chalmers, 1892).

Type. The holotype is the specimen figured by S. Buckman (1888 pl. XX, figs. 13—14). It was found in the lower part of the Crackment Limestones (topmost Upper Bajocian, Parkinsoni Zone, Bomfordi Subzone), Bradford Abbas (Dorset), England. Dimensions of the holotype as shown by a cast: max. diam. 35 mm. (aperture is not preserved); at 25 mm.: 12.0 mm. (0.48), 7.0 mm. (0.28), 6.0 mm. (0.24); at 33 mm.: 14.5 mm. (0.44), 10.0 mm. (0.30), 8.5 mm. (0.26). Type series — 1 English specimen. The holotype is kept in the Sedgwick Museum, the University, Cambridge (SM. J6417).

Description. A medium sized, slightly elliptically coiled species. The ornamentation consists of slightly prorsiradiate inner striae, seen only on the initial parts of the last whorl, and outer slightly rursiradiate ribs, each of which is surmounted on the ventrolateral edge by a node. The outer ribs become slightly stouter towards the ventrolateral edge. The umbilicus is moderately wide, the umbilical walls are low and vertical and the umbilical edge is extremely rounded. The venter is moderately wide and keeled.

Comparison. There are no close species with which *O. (O.) nodifer* could be confused. *O. (O.) nodifer* seems to be the ancestral species of the Upper Bathonian — Callovian *Oecotraustes (Thraxites)*, but no species of that subgenus shows any exact resemblance with this species.

Distribution. Topmost Upper Bajocian (Parkinsoni Zone, Bomfordi Subzone). For the locality and age of the holotype and one topotype see under "Type" above. Arkell (1951c) considered this species, with *O. (O.) costiger*, to be an entirely Zigzag Zone species, but new researches have shown that these are topmost Upper Bajocian species occurring in England below the basal horizon of the Zigzag Zone. In Bulgaria the species was found in the Coarse Oolite Horizon at the village Dolny Lom (Vidin) (see

pl. II, fig. 3 of this paper); the horizon in question is thought to contain condensed Zigzag-Subcontractus Zones, but some Upper Bajocian elements at least may be present. The specimen of Sapunov & Nachev (1959) was found in unzoned Bajocian or Bathonian sediments near the village of Gintsi (Sofia), Bulgaria.

Oecotraustes (Oecotraustes) bomfordi Arkell

Pl. I, figs. 2—3

1919. *Oecotraustes genicularis* Waagen; de Grossouvre, p. 408, pl. XIV, fig. 3.

1951c. *Oecotraustes (Oecotraustes) bomfordi* Arkell, p. 68, pl. VII, figs. 10—14.

Type. The holotype is the specimen figured by Arkell (1951c, pl. VII, fig. 12) and found in the Zigzag Bed (Zigzag Zone) at Powerstock Station quarry (Dorset), England. Dimensions of the holotype as measured on a cast: max. diam. 31 mm. (the base of the lateral lappets are preserved); at 30 mm.: 14.0 mm. (0.46), —, 6.0 mm. (0.20). Type series — 14 specimens. The holotype is kept in the Sedgwick Museum, the University, Cambridge (SM. J29002).

Description. A small, involute, regularly coiled species. The ornamentation consists of dense falcate ribs, the inner parts of which are striae-like, while the outer parts are well differentiated; on the ventrolateral edge each rib ends in a forward elongated inflation. At the aperture the ribbing diminishes but does not wholly disappear, remaining as dense as before. The umbilicus is small, surrounded by moderately high umbilical walls and a sharp umbilical edge. The venter is narrow and keeled, in some specimens appearing slightly tricarinate at the aperture, as two ventrolateral carinae replace the rows of the anteriorly inflated rib-endings. The keel remains sharp as far as the aperture.

Comparisons. *O. (O.) bradleyi* is the only close species, but it is still larger and has a different style of ribbing, comprising weak ribs which become stronger only on the ventrolateral edge, end in small nodules, and are noticeably spaced towards the aperture. *O. (O.) westermanni* shows a similar, though not the same, type of ribbing, but has a much more open umbilicus and an extremely rounded umbilical edge.

Distribution. Lower Bathonian (Zigzag Zone). For the locality and age of the holotype and two of the paratypes from the same locality see under "Type" above; other paratypes have been found in the Zigzag Bed (Zigzag Zone) at Burton Bradstock Allotments quarry and in the Burton Bradstock cliff section (Dorset), England. An indistinguishable French specimen (de Grossouvre, 1919) has been found in the Oolite Ferrugineuse (Upper Bajocian near Bayeux, Normandy, France), which suggests that the species has a wider stratigraphical range. A crushed Bulgarian specimen was found in unzoned Bathonian sediments near the village of Gintsi (Sofia) (Coll. BAN, no. J596). There is a further specimen (Coll. BAN, no. J1032) which was found in the Coarse Oolite Horizon at the village Dolny Lom (Vidin), Bulgaria, which contains condensed Zigzag-Subcontractus Zones and perhaps also some Upper Bajocian elements.

Oecotraustes (Oecotraustes) bradleyi Arkell

Pl. II, figs. 1—2

1951c. *Oecotraustes (Oecotraustes) bradleyi* Arkell, p. 68, pl. VII, figs. 1a, b and 2; see also fig. 9.

1964. *Oecotraustes (Oecotraustes) bradleyi* Arkell; Wendt, p. 125 [69], pl. 18, figs. 5a, b, c.

Type. The holotype is the specimen figured by Arkell (1951c, pl. VII, fig. 1) and was found in the Zigzag Bed (Zigzag Zone) at Powerstock Station quarry (Dorset), England. Dimension of the holotype measured on a cast: max. diam. 43 mm. (at preserved lappets); at 35 mm.: 17.0 mm. (0.48), 7.5 mm. (0.21), 7.0 mm. (0.20); at 43 mm.: 18.0 mm. (0.42), 9.5 mm. (0.22), 9.0 mm. (0.21). Type series—8 specimens. The holotype is kept in the Sedgwick Museum, the University, Cambridge (SM. J29004).

Description. A medium size to large involute species, the microconchs of which (± 35 —40 mm.; cf. the holotype and the Sicilian specimen) are slightly elliptically coiled, while the macroconchs (± 50 mm. and over; cf. Arkell 1951c, pl. VII, fig. 2) are almost regularly coiled. The ornamentation consists of extremely weak falcate ribs which become stronger just before the ventrolateral edge, on which they end in small nodules. On the last quarter of the last whorl the ventrolateral nodules suddenly fade and disappear, but two small ventrolateral carinae, which replace the row of nodules, persist to the end of the conch. Before the aperture the ribs are more widely spaced and the whole ornamentation diminishes, the ribs becoming reduced to striae. The umbilicus is small and slightly uncoiled; the umbilical walls are vertical and comparatively high; the umbilical edge is well differentiated, even sharp. The venter is narrow and keeled. The keel fades slightly towards the aperture, but does not wholly disappear; thus the venter becomes slightly rounded and is here wider and faintly tricarinate.

Comparisons. *O. (O.) bomfordi*, the only close species, is smaller and, more important, its outer ribs are longer and better differentiated, remaining dense (though weaker) towards the aperture. The Upper Bajocian *O. (O.) westermanni* is considerably more evolute and its ribbing remains dense up to the end of the conch.

Distribution. Lower Bathonian (Zigzag Zone). For the locality and age of the holotype and one of the paratypes from the same locality see under "Type" above; the other paratypes were found in the Zigzag Bed (Zigzag Zone) at Burton Bradstock Allotments quarry and in the Burton Bradstock cliff section (Dorset), England. Three specimens have also found in Sicily in condensed (0.20 m.) Lower-Upper Bathonian sediments at a section in Monte Erice (Monte San Giuliano) near the town of Trapani (Wendt, 1964).

Oecotraustes (Oecotraustes) bakalovi sp. nov.

Pl. II, figs. 5—6

Type. The species is named after the late Bulgarian palaeontologist P. Bakalov. The holotype (pl. II, fig. 5) was found in the Polaten Limestones, Serrigerus Bed ("Retrocostatum" Zone) near the village Glojane (Teven), Bulgaria. Dimensions of the holotype measured on the original: max.

diam. 26 mm. (aperture is not preserved); at 20 mm.: 9.0 mm. (0.45), 5.0 mm. (0.25), 5.2 mm. (0.26); at 25 mm.: 13.0 mm. (0.52), 7.3 mm. (0.29), 7.5 mm. (0.30). Type series — 3 Bulgarian specimens. The holotype is kept in the Museum at the Geological Institute, Bulgarian Academy of Sciences, Sofia (Coll. BAN, no. J588).

Description. A small species, septate to 14–15 mm. No specimens with preserved lappets are known, but the body chamber seems to occupy almost the whole of the last whorl. All the available specimens are strongly elliptically coiled. The ribbing is fine, dense and sigmoidal. The inner part of every rib is striae-like, but its rursiradiate outer part is well differentiated and has a strong relief. A small nodule surmounts every rib on the ventrolateral edge. The umbilicus is moderately open, the umbilical walls are low and vertical, and the umbilical edge is very rounded. The venter is narrow and keeled.

Comparison. There are no closely-related Bathonian species. *O. (O.) genicularis* from the Upper Bajocian, though comparable, is considerably more regularly coiled, more evolute and has still denser ribbing. *O. (O.) westermanni* is much larger and is also more regularly coiled. The Lower Bathonian *O. (O.) bomfordi* is much more involute, with a sharp umbilical edge.

Distribution. The species appears to be restricted to the "Retrocostatum" Zone. The age and locality of the holotype was mentioned under "Type" above. One of the paratypes (BAN, no. J598; see pl. II, fig. 6 of this paper) was found in strata that contain a "Retrocostatum" Zone fauna in the section at the village of Dolna Riksa (Michailovgrad), Bulgaria, and the other (BAN no. J593) — in unzoned Bathonian sediments near the village of Gintsi (Sofia), Bulgaria.

Subgenus *Paroecotraustes* Spath, 1928, p. 78

Nomenclature. Type species by original designation is *O. serrigerus* Waagen. However, Spath (1928, p. 78) did not interpret *O. serrigerus* according to its lectotype [Waagen, 1869, pl. XX(5), fig. 7] designated by Lissajous (1923, p. 120), but according to a specimen of Waagen [1869, pl. XX(5), fig. 8] which was renamed later on by me as *O. (P.) waageni* (see J. Stephanov, 1961b). It must, therefore, be considered that Spath misidentified the type species of his *Paroecotraustes* and under Art. 70 (a) an Application to ICZN is needed to ask the Commission, by use of its plenary power, to designate either *O. serrigerus* or *O. waageni* as the type species of subgenus *Paroecotraustes* Spath, 1928.

It seems to me that *O. (P.) waageni* is more suitable for such a type designation, because it is common and more widely distributed than *O. (P.) serrigerus*, which is an extremely rare species.

Diagnosis. Small ammonites (± 20 –60 mm. when adult) with very narrow (± 0.15) to moderately open (± 0.35) umbilicus. Venter fastigate and smooth. Ribbing, more or less acutely angular, varies from striae-like to very strong, outer ribs often being surmounted by ventrolateral nodules, nodes or clavi. Spiral groove more or less distinct. Sexual dimorphism as in the genus. Lower Bathonian — Upper Bathonian [Arkell's statement (1957, p. L276) that the range of the subgenus is Middle Bathonian — Callovian is misleading].

Comparisons. *Oecotraustes* (*Oecotraustes*) have sygmoidal or falcate ribbing and lack a spiral groove. *Pseudoeocotraustes* have bifurcate ribs on the ventrolateral edge which cross the keeled venter forming small chevrons. *Thraxites* have dense sygmoidal or falcate ribbing on the phragmocone which on the body chamber become more widely spaced with exaggerated ventrolateral clavi.

Oecotraustes (*Paroecotraustes*) *subfuscus* Waagen

Text-fig. B, no. 1

1869. *Oecotraustes subfuscus* Waagen, p. 229(51), pl. XX(5), figs. 6a, b.
non 1919. *Oekotraustes subfuscus* Waagen; de Grossouvre, p. 409, pl. XIV, fig. 4.
non 1923. *Oecotraustes* cf. *subfuscus* Waagen; Lissajous, p. 124, pl. XXVI, fig. 12.
non 1935. *Oecotraustes subfuscus* Waagen; de Brun, p. 45, pl. III, fig. 4.
1951c. *Oecotraustes subfuscus* Waagen; Arkell, text-fig. 13, no. 6 (refiguring of the holotype).
non 1961. *Oppelia* cf. *subfusca* Waagen; Gassanov, p. 114, pl. XIII, fig. 7 (= *Oecotraustes* indet.).
non 1961. *Oecotraustes* cf. *subfuscus* (Waagen, 1869); Sibirjakova, p. 47, pl. V, fig. 12 [= *O. (P.) maubeugei*].

Type. Waagen's specimen [1869, pl. XX(5), fig. 6] must be considered as the holotype of this species, because it was the only specimen certainly referred to this species [Arts. 72(b) and 73(a)]. It was found in Bathonian sediments at St. Pezenne, near Niort (Deux Sèvres), France, of the Zigzag Zone (Ferruginea Zone of Waagen). The holotype, being crushed, was not measured by Waagen; he only pointed out [see his p. 229 (51)] that the maximum diameter of his figured specimen was 28 mm. Dr. K.-W. Barthel kindly informed me that the holotype must be regarded as lost. The species strongly needs a neotype selection.

Description. This is stratigraphically the earliest known *Oecotraustes* (*Paroecotraustes*), but up till now the species is only known by the holotype. All other specimens that were figured by different authors as "*subfuscus*" do not, in fact, belong to *O. (P.) subfuscus*. There have been a number of specimens quoted under this name in lists only but not figured, which I have not been able to revise.

This is a small, evolute and elliptically coiled species. The ribbing appears on the last whorl but one and is dense and strongly angular. The inner ribs are prorsiradiate and give rise to one or, more frequently, two rursiradiate outer ribs that end in small ventrolateral nodules. Just before the aperture the ribbing fades but, according to Waagen's figure, it does not wholly disappear. The spiral groove is well differentiated but narrow. The umbilicus is wide for an *Oecotraustes* (*Paroecotraustes*). The venter is narrow and fastigate; towards the aperture the keel fades but still persists to the end of the preserved part of the body chamber.

Comparisons. *O. (P.) formosus*, which seems to be a direct derivative of *O. (P.) subfuscus*, is the closest species. It, however, differs in having denser ribbing and in possessing a second spiral groove very close to the umbilicus; besides, it is considerably more involute. *Oecotraustes angustus* H. Douvillé (1916, pl. III, fig. 6) is comparable and could be an

ancestor of *O. (P.) subfuscus* (if not its junior subjective synonym), but this needs further clarification.

Distribution. Zigzag Zone. For the locality and age of the holotype, the sole known specimen of this species, see under "Type" above.

Oecotraustes (Paroecotraustes) formosus Arkell

Pl. III, figs. 1—8

1951b. *Oecotraustes (Paroecotraustes) formosus* Arkell, p. 8, pl. I, figs. 4—5.

1951c. *Oecotraustes (Paroecotraustes) formosus* Arkell; Arkell, p. 71, pl. VIII, figs. 8—10; text-fig. 18, nos. 2 and 3.

non 1959. *Oecotraustes (Paroecotraustes) formosus* Arkell; Sapunov & Nachev, p. 60, pl. VI, fig. 8 [= *O. (O.) costiger*] and fig. 12 [= *Oioxyites (Prohecticoceras)* indet.].

Type. The holotype is the specimen figured by Arkell (1951b, pl. I, fig. 4). It was found in the Aspidoides Beds (condensed Subcontractus—Morrisi Zones), Holz-Berg near Schwandorf (Oberpfalz), Germany. Dimensions of the holotype as measured on a cast: max. diam. 33 mm. (aperture is not preserved); at 25 mm.: 12.5 mm. (0.50), 7.0 mm. (0.28), 6.5 mm. (0.26); at 33 mm.: 16.0 mm. (0.48), 8.0 mm. (0.24), 7.5 mm. (0.23). Type series—2 specimens. The holotype is kept in the Museum at the Geologisches Institut der Eidgenössischen Technischen Hochschule, Zürich (Coll. L. Krumbeck).

Description. Small to medium-sized *Oecotraustes (Paroecotraustes)*. In the available collection of about 15 Schwandorf topotypes microconchs (± 20 —25 mm.) that are slightly elliptically coiled and macroconchs (± 35 and over) that are almost regularly coiled can be recognized. The ornamentation is very dense and appears early on the inner whorls. The inner ribs are strongly prorsiradiate, thin and wider spaced than the outer ribs which are strongly rursiradiate and slightly arched, very dense and without nodules or clavi, but with very slight inflations on the ventrolateral edge. A characteristic feature of this species is the clear bifurcation of some of the outer ribs immediately after the deep median spiral groove. Arkell (see synonymy) described a second spiral groove which appears at umbilical edge on the second half of the last whorl and such a groove does exist on some (but not on all) specimens. The diameter of the umbilicus shows some variation, in some specimens being moderately wide but small in others. The umbilical walls are low and vertical and the umbilical edge is comparatively sharp. The venter is moderately wide and fastigate but the keel fades towards the aperture and the venter becomes rounder.

Comparisons. *O. (P.) subfuscus* seems very close but possesses more widely spaced ribbing, wider umbilicus and is generally more elliptically coiled. *O. (P.) ziegléri* is easily distinguishable by its shallow spiral groove, more widely spaced inner and outer ribs, the latter being surmounted on the ventrolateral edge by small claviform nodes. *O. (P.) serrigerus* is also easily distinguishable by its weak spiral groove and small nodes at the end of the outer ribs. *O. (P.) parvus* cannot be confused because it is much smaller, evolute, lacks inner ribs and has much more widely spaced outer ribs.

Distribution. Progracilis Zone to, most probably, Morrisi Zone. The locality and age of the holotype, the paratype and the topotypes here mentioned see under "Type" above. Arkell's specimens (1951c, pl. VIII, figs. 8—10) have been collected from the Stonesfield Slates (Progracilis Zone),

Stonesfield (Oxon), England. A typical and stratigraphically well localized specimen was recently found and kindly sent to me by Mr. H. S. Torrens in a steem section of Fuller's Earth Rock, Thornford Beds (Subcontractus Zone) near the Lasher, Trill farm (Yeovil, Somerset), England (Coll. H. S. Torrens, no. HT3918).

***Oecotraustes (Paroecotraustes) ziegleri* sp. nov.**

Pl. VII, figs. 6–8; text-fig. B, no. 6

Type. The species is named after the German palaeontologist B. Ziegler. The holotype (pl. VII, fig. 6) was found in the Prevala Beds (Desivich Oolite Limestone, condensed Subcontractus — “Retrocostatum” Zones) near the village of Prevala (Michailovgrad), Bulgaria. Dimensions of the holotype as measured on the original: max. diam. 29 mm. (the base of the lateral lappets are preserved); at 25 mm.: 10.5 mm. (0.42), 6.0 mm. (0.24), 7.0 mm. (0.28). Type series — 11 specimens (10 Bulgarian and 1 Azerbaidgianian). The holotype is kept in the Museum at the Geological Institute, Bulgarian Academy of Sciences, Sofia (Coll. BAN, no. J848).

Description. A small elliptically coiled species. The ornamentation appears on the last whorl but one and is strongly angular. The inner ribs are prorsiradiate, widely spaced and vary from striae to strong bullae. The outer ribs are rursiradiate, dense and distinct but towards the aperture they fade becoming striae-like or are even absent. On the ventrolateral edge each ends with a small clavus; rows of these on both sides of the keel give a tricarinate appearance to the venter. Towards the aperture the keel fades and the venter here is blunt and rounded. The spiral groove is distinct but in some specimens it is weaker. The umbilicus is moderately wide and is surrounded by very low and vertical umbilical walls and by an extremely rounded and blunt umbilical edge.

Comparisons. *O. (P.) serrigerus* is the closest species and is sometimes undistinguishable. The difference lies in the outer ribs which in *O. (P.) serrigerus* become almost radial and straight just before the aperture, while in the species under consideration they remain strongly rursiradiate. Besides, in *O. (P.) serrigerus* they are surmounted by nodes, replaced in *O. (P.) ziegleri* by clavi. Further, the venter of *O. (P.) serrigerus* does not possess a tricarinate appearance like the venter of the present species. *O. (P.) formosus* has a much denser ornamentation and also two spiral grooves. *O. (P.) parvus* is much more evolute and has more widely spaced ribbing. *O. (P.) maubeugei* is too large to be mistaken for *O. (P.) ziegleri*, while *O. (P.) splendens* possesses considerably rougher and widely spaced ribs.

Distribution. The species seems to range from Subcontractus to “Retrocostatum” Zones, but it could also have a more restricted stratigraphical distribution. For the locality and age of the holotype and the Bulgarian paratypes see under “Type” above. The Azerbaidgianian paratype, whose cast is now before me, was found in sediments that were wrongly thought to be of Middle Callovian age, but which are now known to be of Upper Bathonian age; the locality is near the village of Tonashen (Nagornyi Karabakh, Minor Caucasus), Azerbaidgan, USSR (Coll. T. A. Gassanov).

Oecotraustes (Paroecotraustes) serrigerus Waagen

Pl. III, figs. 12—13; text-fig. 13, no. 2

1869. *Oecotraustes serrigerus* Waagen, p. 230(52) (pars), pl. XX(5), figs. 7a, b, c (lectotype designated by Lissajous, 1923, p. 120) [non figs. 8a, b, c = *O. (P.) waageni*].
- non 1888. *Ammonites serrigerus* Waag.; de Grossouvre, p. 376, pl. IV, figs. 2a, b [= *O. (P.) maubeugei*] and figs. 3a, b [= *O. (P.) prevalensis*].
- non 1888. *Ammonites (Oecotraustes) serrigerus* Waagen; Fritel, pl. VI, figs. 18—19 [= *O. (P.) waageni*].
- non 1923. *Oecotraustes serrigerus* Waagen; Lissajous, p. 120, pl. XXVI, figs. 1—3 [= *O. (P.) maubeugei*], fig. 4 [= *Oecotraustes (Paroecotraustes)* sp.] and fig. 5 [= *O. (P.) waageni*].
- non 1927. *Oecotraustes serrigerus* Waagen; P. Dorn, p. 247, pl. VII, figs. 5—7 (Lower Bathonian *Oecotraustes* spp.).
- non 1930. *Paroecotraustes* aff. *serrigerus* (Waagen); Spath, p. 29, pl. II, fig. 15.
- non 1930. *Oekotraustes serrigerus* Waagen; de Grossouvre, p. 377, pl. XXXIX, fig. 10 [= *O. (P.) waageni*].
- non 1934. *Oecotraustes serrigerus* Waagen; Stoll, p. 33, pl. III, fig. 8a [= *Oecotraustes (Paroecotraustes)* sp.] and fig. 8b (Oppellid nucleus).
- 1951c. *Oecotraustes serrigerus* Waagen; Arkell, text-fig. 13, no. 7a, b, c (refiguring of the lectotype).
- non 1951c. *Oecotraustes* aff. *serrigerus* Waagen; Arkell, text-fig. 13, nos. 8a, b, c [refiguring of Waagen, 1869, pl. XX(5), figs. 8a, b, c = *O. (P.) waageni*].
- non 1951c. *Oecotraustes (Paroecotraustes)* cf. *serrigerus* Waagen; Arkell, p. 69, pl. VIII, fig. 4 [indet. worn specimen probably of *O. (P.) maubeugei*].
- non 1958. *Oecotraustes serrigerus* Waag.; Collignon, pl. X, figs. 54 and 54a [= *O. (P.) collignoni*].
- non 1958. *Paroecotraustes (Paroecotraustes) serrigerus* (Waagen, 1876); Westermann, p. 37, pl. 1, figs. 6a—e and 7a—e [= *O. (P.) waageni*].
- non 1959. *Oecotraustes serrigerus* Waagen; Arkell, p. 245 [GSM. Bi9651 = *O. (P.) waageni*; Hodson's specimens = *O. (P.) maubeugei*].
1961. *Oecotraustes (Paroecotraustes) serrigerus* Waagen; J. Stephanov, p. 828, text-figs. 1a, b (the neotype).

Type. The lectotype was designated by Lissajous (1923, p. 120) and it is Waagen's specimen 1869, pl. XX(5), fig. 7. Waagen's other figured specimen [1869, pl. XX(5), fig. 8] does not belong to this species and I have renamed it as *O. (P.) waageni* (see J. Stephanov, 1961b, p. 829). The lectotype of *O. (P.) serrigerus* was thought to be found in rocks that contain a fauna of Waagen's Aspidoides Zone (probably the whole Upper Bathonian according to the present classification); the locality is near the village of Balin (Cracow), Poland. Dr. K.-W. Barthel kindly informed me that the lectotype and the whole type series must be considered as lost. A Bulgarian specimen was designated by me as the neotype of this species (J. Stephanov, 1961b, p. 829) after I had discovered in 1961 that no topotypes exist in any Polish museum or can now be found in the type locality of the species. The neotype was found in the Polaten Limestones (*Serrigerus* Bed; "Retrocostatum" Zone) near the village of Glojane (Teteven), Bulgaria. The *Serrigerus* Bed was thought to yield an Aspidoides Zone fauna, but now I am prone to regard this fauna as earlier, belonging to the "Retrocostatum" Zone. Dimensions of the neotype as measured on the original max. diam. 27 mm. (aperture is not preserved); at 25 mm.: 11.0 mm. (0.44), 6.0 mm. (0.24), 7.5 mm. (0.30). The neotype is kept in the Museum at the Geological Institute, Bulgarian Academy of Sciences, Sofia (Coll. BAN, no. J601).

Description. This is a rare, small species known up till now by only 4 specimens (incl. the lectotype), none of which possess preserved lap-

pets. This is a comparatively regularly coiled species whose ornamentation appears early on the inner whorls. The inner ribs are prorsiradiate, widely spaced and distinct, especially on the inner whorls, but on the last whorl they fade and are reduced to low irregular inflations or, sometimes, striae. The outer ribs are rursiradiate, dense, well differentiated and ending in small nodes on the ventrolateral edge. The final outer ribs just before the end of the body chamber become more radial and this is a very characteristic feature of this species. The spiral groove is extremely weak or absent. The umbilicus is open and the umbilical walls are very low and steep without an umbilical edge. The venter is fastigate and almost without a shoulder.

Comparisons. *O. (P.) zieglei* is the nearest species but this has strongly rursiradiate outer ribs, more distinct inner ribs and the venter appears tricarinate. *O. (P.) formosus* is easily distinguished by its denser ribbing, its two spiral grooves and by the lack of ventrolateral nodes or clavi. *O. (P.) parvus* is considerably more evolute and its ribs are more widely spaced. *O. (P.) paradoxus* has weak ribs and cannot be mistaken for *O. (P.) serrigerus*.

Records of this species are very widespread and in the past this name has often been given to almost every specimen of *Oecotraustes*. During the revision of this genus it was established that a number of specimens belonging to *O. (P.) maubeugei*, *O. (P.) prevalensis* and even *O. (P.) collignoni* had been wrongly named "*Oecotraustes serrigerus*", with which they have nothing in common. Comparisons of these species with *O. (P.) serrigerus* will not, therefore, be made here. Another confusion arose because of the fact that Waagen did not designate the type of his "*Oecotraustes serrigerus*" and authors applied this name to specimens which are today known to belong to *O. (P.) waageni*; the latter species, also, has nothing in common with *O. (P.) serrigerus* and comparisons will not be made between these here.

Distribution. The species seems to occur in "Retrocostatum" Zone only, although some specimens have been found in condensed beds that contain faunas of more than this one zone. Previous statements that the species occurs in the Aspidoides Zone may be misleading. The locality and age of both lectotype and neotype were discussed under "Type" above. Another Bulgarian specimen (see pl. III, fig. 13 of this paper) was found in the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria.

***Oecotraustes (Paroecotraustes) parvus* (Westermann)**

Pl. V, fig. 9

1911. *Oecotraustes paradoxus* Roemer, p. 41 (pars), pl. IV, fig. 33; pl. VII, fig. 14 (only)
1958. *Paroecotraustes (Paroecotraustes) parvus* Westermann, p. 39, pl. 2, figs. 4 and 5.

Type. The holotype is the specimen figured by Westermann (1958, pl. 2, fig. 4) which is the same specimen that was figured by Roemer (1911, pl. VII, fig. 14) as "*Oecotraustes paradoxus* var.". The holotype was found in the Aspidoides Schichten, the lower part of which (Westermann's *Paradoxus* and *Densicostatus* Subzones) was placed by Torrens (1965) in the "Retrocostatum" Zone; the locality is Lechstedt (Hildesheim), Germany. Dimensions of the holotype as measured on the original: max. diam. 21 mm. (the aperture is not preserved); at 20 mm.: 7.5 mm. (0.37), 5.5 mm. (0.27),

7.0 mm. (0.35). Type series — 6 specimens. The holotype is kept in the Museum at the Georg-August University, Göttingen (Coll. Gött., no. Ldt 42).

Description. This is a rare species. The holotype is small, slightly elliptically coiled and is septate to 17 mm., the last two septal sutures being crowded together, thus indicating that the specimen is adult. The ornamentation appears early. Inner ribs are absent but the species has prorsiradiate striae on the inner whorls which on the body chamber become extremely low in relief and inflated like very wide ribs. The outer ribs are strong, rursiradiate but slightly arched; on the ventrolateral edge they are enlarged but lack nodes or clavi. The spiral groove is distinct but weak. The umbilicus is wide; the umbilical walls are strongly sloping with a rounded umbilical edge. The venter is moderately wide and keeled. The species has a characteristic roundedly triangular whorl section.

Comparisons. *O. (P.) paradoxus* is a close species but has a considerably weaker ornamentation and is more elliptically coiled. *O. (P.) serri-gerus* possesses denser ribbing and has ventrolateral nodes; besides, its final outer ribs at the aperture are characteristically more radially developed and straight and the species is considerably more involute.

Distribution. The species seems to be restricted to the "Retrocostatum" Zone only. For the locality and age of the holotype and the paratypes see under "Type" above.

Oecotraustes (Paroecotraustes) paradoxus J. Roemer

pl. V, fig. 8

1911. *Oecotraustes paradoxus* J. Roemer, p. 41 (pars), pl. IV, fig. 32; pl. VII, fig. 13 (only).
non 1923. *Oecotraustes paradoxus* J. Roemer; Lissajous, p. 123, pl. XXV, fig. 13; pl. XXVI, fig. 11.
non 1930. *Oekotraustes paradoxus* J. Roemer; de Grossouvre, p. 378, pl. XXXIX, fig. 7.
1958. *Paroecotraustes (Paroecotraustes) paradoxus* (J. Roemer, 1911); Westermann, p. 38, pl. 2, figs. 1a, b, c and 3 (non fig. 2).

Type. Roemer's type designation is valid (1911, see the explanation of pl. VII, fig. 13) and the holotype of the species is the specimen on pl. VII, fig. 13. It was found in *Aspidoides* Schichten, the lower part of which (Westermann's *Paradoxus* and *Densicostatus* Subzones) was placed by Töres (1965), in the "Retrocostatum" Zone; the locality is Lechstedt (Hildesheim), Germany. Dimensions of the holotype as measured on the original: max. diam. 24 mm. (the base of the lateral lappets is preserved); at 24 mm.: 9.0 mm. (0.38), 6.0 mm. (0.25), 8.0 mm. (0.33). Type series — 3 specimens. The holotype is kept in the Museum at the Georg-August University, Göttingen (Coll. Gött., no. Ldt 41).

Description. This is a rare, small, elliptically coiled species. The holotype is septate to 18 mm., the last few septal sutures being slightly approximated which suggests that the specimen is adult. The ornamentation first appears on the last whorl and is weak and angular. The initial ribs are like striae, especially the inner ribs, while the outer ribs are slightly arched. At the beginning of the body chamber the outer ribs become well differentiated, moderately well spaced and slightly enlarged towards the ventrolateral edge, but do not develop any nodes or clavi; the inner ribs here remain striae-

like, though they are a little more distinct. At the aperture the ribbing almost entirely disappears. The spiral groove is well differentiated, but is weak. The umbilicus is wide and the umbilical walls are sloping, with a very rounded umbilical edge. The venter is narrow and keeled, but the keel fades towards the aperture, the venter becoming wider and more rounded.

Comparisons. *O. (P.) parvus* is the closest species, but it is more regularly coiled and has considerably stronger outer ribs. *O. (P.) waageni* is much larger and cannot be confused with the species under consideration.

Distribution. The species seems to be restricted to the "Retrocostatum" Zone only, and Westermann (1958, p. 22 and 39) shows that it is confined in N. W. Germany to the lower part of the *Aspidoides* Schichten ("Retrocostatum" Zone sensu Torrens, 1965). For the locality and age of the holotype, paratypes and topotypes see under "Type" above.

***Oecotraustes (Paroecotraustes) maubeugei* sp. nov.**

Pl. V, figs. 1–7; pl. VI, figs. 1–8

1888. *Ammonites serrigerus* Waag.; de Grossouvre, p. 376, pl. IV, figs. 2a, b (only).

1923. *Oecotraustes serrigerus* Waagen; Lissajous, p. 120, pl. XXVI, figs. 1–3 (non cetera).

1959. *Oecotraustes serrigerus* Waagen; Arkell, p. 245 (Hodson's specimens only).

1961. *Oecotraustes* cf. *subfuscus* (Waagen, 1869); Sibirjakova, p. 47, pl. V, fig. 12.

Type. The species is named after the French palaeontologist P. L. Maubeuge. The holotype (pl. V, fig. 1) was collected from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Dimensions of the holotype as measured on the original: max. diam. 57 mm. (the base of the lateral lappets is preserved); at 40 mm.: 18.0 mm. (0.45), 10.0 mm. (0.25), 10.0 mm. (0.25); at 55 mm.: 23.0 mm. (0.42), 13.0 mm. (0.24), 14.0 mm. (0.25). Type series — 74 specimens. The holotype is kept in the Museum at the Geological Institute, Bulgarian Academy of Sciences, Sofia (Coll. BAN, no. J581).

Description. This is the most widely distributed and commonest *Oecotraustes (Paroecotraustes)* known from the whole of Europe. Its microconchs (± 35 –40 mm.) are more elliptically coiled, even scaphitoid, while the macroconchs (± 50 –55 mm.) are less elliptically coiled. The inner whorls are without ornamentation and the species shows large variability concerning the appearance of the ribs; in some individuals these appear very late and such specimens are smooth even on the initial parts of the last whorl, while in other individuals the ribbing appears very early and such specimens show strong ornamentation during the whole growth stage of the conch. The ribbing is angular. The inner ribs are prorsiradiate and quite widely spaced and are in some individuals almost entirely lacking, but in others they are strong and rough. The outer ribs are rursiradiate, moderately dense, each ending in a small claviform inflation on the ventrolateral edge. Generally, the ribbing diminishes towards the aperture and becomes acutely angular, the outer ribs losing their ventrolateral claviform inflations. The spiral groove is weak. The umbilicus is moderately open and is surrounded by low and steep umbilical walls and a distinct but rounded umbilical edge. The venter is fastig-

ate, but the keel fades and disappears entirely towards the aperture, with the venter becoming wider, blunt and rounded.

Comparisons. This is the largest of all known *Oecotraustes* (*Paroecotraustes*). *O. (P.) waageni*, which also is a large species, has much more widely spaced and less angular ribbing which is generally weaker than that of *O. (P.) maubeugei*. *O. (P.) prevalensis* is another closely related species but it has no inner ribs and its outer ribbing is much denser. *O. (P.) densicostatus*, although insufficiently characterised specifically, seems to differ in the absence of inner ribs and in the earlier appearance of the outer ribs. *O. (P.) zieglerei* is a small species and cannot be mistaken for *O. (P.) maubeugei*.

Distribution. The stratigraphical range of this species may be from Subcontractus to Aspidoides Zones. From uncondensed beds it is only known from "Retrocostatum" and Aspidoides Zones, but its acme is certainly in "Retrocostatum" Zone. For the locality and age of the holotype and some of the paratypes see under "Type" above. A Bulgarian paratype was found in the Vratnishki Limy Sandstones (Ragin Bed; condensed "Retrocostatum" and Aspidoides Zones) near the village of Prevala (Michailovgrad), Bulgaria, and others in unzoned Bathonian sediments near the village of Belotontsi (Vidin). In England several fragmentary paratypes were found in the Rugitela Beds ("Retrocostatum" Zone) in the neighbourhood of Whatley (Somerset), and also a specimen from the Twinhoe Ironshot (Aspidoides Zone), Twinhoe Quarry near Bath (Somerset) (Bristol University Museum, no. 13490); the latter is the sole known specimen from the Aspidoides Zone. In France the species is known from both "Zone à Zigzagiceras arbusigerum" and "Zone à Hecticoceras retrocostatum" near Verzé and Davayé (Mâcon) (see Lissajous, 1923); and also from the Upper Bathonian of an undesigned locality in France, probably from a bed towards the base (see de Grossouvre, 1888). The species is known also from Upper Bathonian sediments (probably "Retrocostatum" Zone) near the village of Tsona (Oni, Great Caucasus), Georgia, USSR; and near the water-source Saka (Bolshoyi Balkhan), Turkmenia, USSR (see Sibirjakova, 1961).

***Oecotraustes (Paroecotraustes) prevalensis* sp. nov.**

Pl. VII, figs. 2—5

1888. *Ammonites serrigerus* Waag.; de Grossouvre, p. 376, pl. IV, figs. 3a, b (only).

Type. The species is named after the village Prevala (Michailovgrad), Bulgaria, in which region the holotype (pl. VII fig. 2) was collected in the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones). Dimensions of the holotype as measured on the original: max. diam. 39 mm. (the base of the lateral lappets is preserved); at 30 mm.: 13.5 mm. (0.45), 6.0 mm. (0.20), 7.0 mm. (0.23); at 35 mm.: 15.0 mm. (0.43), 8.0 mm. (0.23), 9.0 mm. (0.26). Type series — 4 specimens (3 Bulgarian and 1 French). The holotype is kept in the Museum at the Geological Institute, Bulgarian Academy of Sciences, Sofia (Coll. BAN, no. J587).

Description. This is a rare species which is moderately large in size and is elliptically coiled. The ornamentation appears very late, on the second half of the last whorl. Inner ribs are absent, but thin prorsiradiate striae can be seen on the inner part of the whorls. The outer ribs are rur-

siradiate, very dense and thin, slightly enlarged on the ventrolateral edge forming there ventrolateral claviform inflations. The spiral groove is weak. The umbilicus is moderately open and the umbilical walls are very low and vertical. The umbilical edge is distinct but rounded. The venter is fastigate and narrow. The keel is acute but fades towards the aperture without completely disappearing, forming a rounded venter.

Comparisons. *O. (P.) maubeugei* is the closest species, but generally it has a rougher ornamentation, wider spaced outer ribs and more distinct inner ribs. *O. (P.) densicostatus* is not a sufficiently clear species, but it seems to differ in the considerably earlier appearance of the outer ribs. *O. (P.) glojanensis* possesses a very small umbilicus and cannot be confused with *O. (P.) prevalensis*.

Distribution. The species probably occurs in Subcontractus — "Retrocostatum" Zones, but it is possible that it has a more restricted stratigraphical distribution. For the locality and age of the holotype and the Bulgarian paratype see under "Type" above. The French paratype was found in the Upper Bathonian of an unlocalised locality in France, probably from a bed towards the base (de Grossouvre, 1888).

***Oecotraustes (Paroecotraustes) densicostatus* Lissajous**

Text-fig. B, nos. 4—5

1923. *Oecotraustes serrigerus* var. *densicostatus* Lissajous, p. 121, pl. XXVI, fig. 6.

Type. The specimen figured by Lissajous (1923, pl. XXVI, fig. 6) is here designated lectotype. It was found in sediments that contain a fauna of the "Zone à Hecticoceras retrocostatum" sensu Lissajous (1923), which is larger than the "Retrocostatum" zone of Torrens (1965). The locality is Davayé (Mâcon), France. Dimensions of the lectotype according to Lissajous (1923, p. 122): max. diam. 37 mm.; at 37 mm.: 15.0 mm. (0.41), 9.0 mm. (0.24), 12.0 mm. (0.32). Type series — 3 specimens. The lectotype is lost, for Dr. R. Enay kindly informs me that it cannot be found in the collection of M. & B. Lissajous in the museum at the University of Lyon. Further search for the type series of this species is needed and if it is definitely lost, a neotype for it must be selected.

Remarks. I am uncertain about this species. All the specimens of the type series seems to be lost as neither Dr. R. Enay nor Dr. E. Basse de Menorval could find any of these specimens in any of the French natural history museums. Lissajous' description and the photographic reproduction of one of his three specimens (the lectotype here designated) are insufficient for an exact definition. Lissajous (see synonymy) only mentioned that this is a comparatively regularly coiled species with a wide umbilicus and numerous, fine outer ribs which appear early, well before the beginning of the body chamber. The poor photographic reproduction adds nothing to this poor original description. However, thus characterized *O. (P.) densicostatus* could embrace at least two or three species of the subgenus — *O. (P.) maubeugei*, *O. (P.) prevalensis* and even *O. (P.) ziegleri*. Is is, therefore, impossible to say if it is a separate species or to give an exact diagnosis. I am reproducing here a specimen (see text-fig. B, no. 5) from the Minor Caucasus Mountains from a locality near the village Novo-Saratovka (river Dzegamchayi), Azerbaidgan, USSR, which seems to be entirely conspe-

citic with *O. (P.) densicostatus*: smooth inner part of the lateral walls and outer ribs that are moderately dense and appear very early on the conch. However, I would emphasize once more that nothing final can be said of this species before a neotype is selected; the name "*densicostatus*" is an available name and, I believe, a valid name, but nevertheless at least for the present I would recommend that authors are cautious when using this name.

***Oecotraustes (Paroecotraustes) glojanensis* sp. nov.**

Pl. VII, figs. 9—11

Type. The species is named after the village of Glojane (Teteven), Bulgaria, where the holotype (pl. VII, fig. 11) was found in the Polaten Limestones (Serrigerus Bed; "Retrocostatum" Zone). Dimensions of the holotype as measured on the original: max. diam. 35 mm. (the aperture is not preserved); at 25 mm.: 14.0 mm. (0.56), —, 4.0 mm. (0.16); at 35 mm.: 17.5 mm. (0.50), —, 5.0 mm. (0.15). Type series — 3 specimens (1 Bulgarian and 2 German). The holotype is kept in the Museum at the Geological Institute, Bulgarian Academy of Sciences, Sofia (Coll. BAN, no. J605).

Description. This is a medium sized, very involute species whose only ornamentation consists of outer ribs. These appear early and are markedly rursiradiate, slightly arched, blunt, thin and dense, but towards the aperture they gradually separate, becoming thicker while remaining blunt. The ribs fade on the ventrolateral edge without forming nodes or clavi, but appear very large and even trianguliform. The spiral groove is distinct, but varies slightly in strength. The very small umbilicus is surrounded by low and vertical umbilical walls and a sharp umbilical edge. The venter is very narrow and has a sharp keel which remains sharp to the aperture.

Comparisons. There are no close species with which *O. (P.) glojanensis* could be confused, because all other *Oecotraustes (Paroecotraustes)* are more evolute. *O. (P.) laevis* and *O. (P.) davaicensis* which are also involute, have an entirely different style of ornamentation and, besides, lack a distinct spiral groove.

Distribution. The species seems to occur in Subcontractus — "Retrocostatum" Zones, but it is possible that it has a more restricted stratigraphical distribution. The locality and age of the holotype were noted under "Type" above. The two German paratypes were found in the Aspidoïdes Beds (condensed Subcontractus — Morrisi Zones), Holz-Berg, Schwandorf (Oberpfalz), Germany.

***Oecotraustes (Paroecotraustes) waageni* J. Stephanov**

Pl. III, figs. 9—11; text-fig. B, no. 3

1869. *Oecotraustes serrigerus* Waagen, p. 230 (52) (pars), pl. XX (5), figs. 8a, b, c (only) [the holotype of *O. (P.) waageni*].
1888. *Ammonites (Oecotraustes) serrigerus* Waagen; Fritel, pl. VI, figs. 18 and 19.
1912. *Oppelia serrigera* var. *heterocostata* Rehbinder, p. 110 (*nomen nudum*).
1914. *Oppelia serrigera* var. *heterocostata* Rehbinder, p. 284 (*nomen nudum*).
1923. *Oecotraustes serrigerus* Waagen; Lissajous, p. 120 (pars), pl. XXVI, fig. 5 (only).
1951c. *Oecotraustes* aff. *serrigerus* Waagen; Arkell, text-fig. 13, no. 8 [refiguring of the holotype of *O. (P.) waageni*].

1958. *Paroecotraustes (Paroecotraustes) serrigerus* (Waagen, 1876); Westermann, p. 37, pl. 1, figs. 6a—e, 7a—e [fig. 6 was selected as the neotype of *O. (P.) waageni*].
1959. *Oecotraustes serrigerus* Waagen; Arkell, p. 245 (only specimen GSM. BI 9651; non cetera).
- 1961b. *Oecotraustes (Paroecotraustes) waageni* J. Stephanov, p. 829, text-fig. 2 (refiguring of the neotype).

Type. Many previous authors felt the necessity of separating the two specimens figured by Waagen as "*Oecotraustes serrigerus*" [1869, pl. XX (5), figs. 7 and 8] into two different species. In 1961, when considering the "*serrigerus*" problem, I followed Lissajous' (1923, p. 120) designation of Waagen's fig. 7 as the lectotype of *Oecotraustes serrigerus* and renamed his fig. 8 as *Oecotraustes (Paroecotraustes) waageni*, designating this figure as the holotype of this species (J. Stephanov, 1961b). The holotype was thought by Waagen to be as from his Aspidoides Zone (which must embrace the whole Upper Bathonian) and was found about 100 years ago in a railway cutting near the village of Balin (Cracow), Poland. However, Dr. K.-W. Barthel kindly informed me that the holotype must be regarded as lost and I designated one of the paratypes of *O. (P.) waageni* (the specimen figured by Westermann, 1958, pl. 1, fig. 6) as the neotype of this species. The neotype was found in the Aspidoides Schichten ("Retrocostatum" or Aspidoides Zones), Lechstedt, near Hildesheim (Lower Saxony), Germany. Dimensions of the neotype as measured on a cast: max. diam, 48 mm. (with wholly preserved aperture); at 45 mm.: 19.5 mm. (0.44), 10.5 mm. (0.23), 11.5 mm. (0.25). Type series — 4 specimens. The holotype is kept in the Museum at the Bundesanstalt für Bodenforschung, Hannover (Coll. Hann., no. b302).

Description. This is one of the largest and commonest *Oecotraustes (Paroecotraustes)* in Europe. The microconchs (± 35 —40 mm.) are markedly elliptically coiled and even appear scaphitoid while the macroconchs (± 45 —50 mm.) are less elliptically coiled. The species has weak ornamentation and the ribbing is not acutely angular, being often sygmoidal. The inner ribs are slightly prorsiradiate, striae-like or weak. The outer ribs are prorsiradiate, very widely spaced, wide and low in relief, without nodes or clavi but they are widely enlarged on the ventrolateral edge. The spiral groove is extremely weak. The umbilicus is moderately open and is surrounded by quite high and vertical umbilical walls with a very blunt umbilical edge. The venter is fastigate with a comparatively strong keel which, however, fades towards the aperture, with the venter becoming wider and more rounded.

Comparisons. *O. (P.) maubeugei* is a close species but it has stronger and much denser ribbing. *O. (P.) laevis* possesses a much smaller umbilicus and cannot be mistaken for *O. (P.) waageni*. There are no other close species.

Distribution. This species seems to occur in "Retrocostatum" and Aspidoides Zones, but probably it is more frequent in the latter zone, its acme being in it. The German holotype and paratype are from Aspidoides or Retrocostatum Zones (see under "Type" above). The Rumanian paratype is from condensed Upper Bathonian — Lower Callovian sediments (see Răileanu et al., 1964, p. 688); the locality is Vadu Crișului, Rumania. The Bulgarian paratype is from unzoned Upper Bathonian sediments near the village Repljana (Vidin); a number of other Bulgarian specimens, crushed or incomplete, were found in various section of Upper Bathonian in N. W. Bul-

garia. Recently three typical specimens were collected by me in the Vratniskhi Limy Sandstones (Ragin Bed; condensed "Retrocostatum" — Aspidoides Zones) near the village of Prevala (Michailovgrad), Bulgaria (coll. BAN, nos. J1058, J1059 and J1065). Arkell's specimen GSM. Bi9651 (1959, p. 245) is from the upper part of the Fuller's Earth Rock ("Retrocostatum" Zone) in a boring at Patterdown, near Chippenham (Wilts), England. All the other specimens mentioned in the synonymy were collected in the past from Bathonian sediments in different European countries and their revised stratigraphical position is not accurately known.

Oecotraustes (Paroecotraustes) laevis Lissajous

Pl. IV, fig. 8

1923. *Oecotraustes laevis* Lissajous, p. 122, pl. XXVI, fig. 7 [non fig. 8=*O. (P.) davaicensis*].

Type. The lectotype here designated is the specimen figured by Lissajous (1923, pl. XXVI, fig. 7). It was found in sediments that contain a fauna of the "Zone à Hecticoceras retrocostatum" (sensu Lissajous, 1923, which is larger than the "Retrocostatum" Zone of Torrens, 1965). The locality is Fuissé (Mâcon), France. Dimensions of the lectotype as measured on a cast: max. diam. 45 mm. (at wholly preserved aperture); at 30 mm.: 16.0 mm. (0.53), 8.5 mm. (0.28), 6.0 mm. (0.20); at 45 mm.: 24.0 mm. (0.53), —, 7.0 mm. (0.155). Type series — 2 specimens. The lectotype is kept in the Museum at the University, Lyon (Coll. M. & B. Lissajous, no. A.4743a).

Description. This is a rare, large, elliptically coiled species. The sole ornamentation consists of several rursiradial, widely spaced outer ribs of low relief which appear on the last quarter of the last whorl, but quickly disappear towards the aperture. The remaining part of the lateral walls is completely smooth, but on their inner part strongly prorsiradial striae can be seen at the aperture. A weak spiral groove is developed on the latter half of the lateral walls. The umbilicus is characteristically small and is surrounded by comparatively high and vertical umbilical walls and a sharp umbilical edge. The venter is narrow and fastigate, but the keel diminishes towards the aperture and the venter becomes wide, blunter and more rounded.

Comparisons. *O. (P.) davaicensis*, being almost entirely smooth, is easily distinguishable. The outer ribbing of *O. (P.) glojanensis* appears earlier and thus it cannot be mistaken for *O. (P.) laevis*. *O. (P.) waageni* has a much wider umbilicus.

Distribution. For the locality and age of the lectotype, the sole known specimen of his species, see under "Type" above.

Oecotraustes (Paroecotraustes) davaicensis Lissajous

Pl. IV, fig. 7

1923. *Oecotraustes davaicensis* Lissajous, p. 122, pl. XXVI, figs. 9, 9a and 10.

1923. *Oecotraustes laevis* Lissajous, pl. XXVI, fig. 8 (only).

Type. The lectotype here designated is the specimen figured by Lissajous (1923, pl. XXVI, fig. 9). It was found in sediments that contain a fauna of the "Zone à Hecticoceras retrocostatum" (sensu Lissajous, 1923, which is larger than "Retrocostatum" Zone of Torrens, 1965). The loca-

lity is Davayé (Mâcon), France. Dimensions of the lectotype as measured on a cast: max. diam. 40 mm. (the aperture is not preserved); at 30 mm.: 16.5 mm. (0.55), 7.5 mm. (0.25), 4.5 mm. (0.15); at 40 mm.: 21.0 mm. (0.52), 9.5 mm. (0.24), 5.5 mm. (0.14). Type series — 2 specimens. The lectotype is kept in the Museum at the University, Lyon (Coll. M. & B. Lissajous, no. A. 4746).

Description. This is a rare, large species that is regularly or slightly elliptically coiled and almost entirely deprived of ornamentation, the lateral walls being smooth, with falcoid striae, whose relief becomes stronger at the point where they change in direction. No spiral groove is present, but just before the aperture a slight depression appears in the middle of the lateral walls. The umbilicus is very small and is surrounded by comparatively high and vertical umbilical walls and a sharp umbilical edge. The venter is narrow and fastigate, but the keel fades strongly towards the aperture, the venter becoming wide, blunter and more rounded.

Comparisons. *O. (P.) laevis* is very close, but has several outer ribs of low relief on the last quarter of the last whorl. *O. (P.) glojanensis* is easily distinguished by the possessing of outer ribs.

Distribution. For the locality and age of the lectotype and paralectotype see under "Type" above. The species has been found also in a section of the same age as the lectotype near Fuissé (Mâcon), France (Lissajous, 1923, pl. XXVI, fig. 8).

***Oecotraustes (Paroecotraustes) splendens* Arkell**

Pl. IV, figs. 1—6

1951b. *Oecotraustes (Paroecotraustes) splendens* Arkell, p. 7, pl. I, fig. 1.

1951c. *Oecotraustes (Paroecotraustes) splendens* Arkell; Arkell, p. 70, pl. VIII, figs. 2, 3a, b, c; text-fig. 18, no. 1 (holotype refigured).

Type. The holotype is the specimen figured by Arkell (1951b, pl. I, fig. 1). It was found in the Aspidoides Beds (condensed Subcontractus — Morrisi Zones), Holz Berg near Schwandorf (Oberpfalz), Germany. Dimensions of the holotype as measured on a cast: max. diam. 37 mm. (with the base of the lateral lappets preserved); at 35 mm.: 15.5 mm. (0.44), 8.5 mm. (0.25), 10.0 mm. (0.29). Type series — 1 specimen. The holotype is kept in the Geologisches Institut der Eidgenössischen Technischen Hochschule, Zürich (Cool. L. Krumbeck).

Description. This is the most variable *Oecotraustes (Paroecotraustes)*. Medium sized, the species encompasses individuals ranging from regularly coiled to highly elliptically coiled and scaphitoid and in this respect no two specimens in the collection of 15 specimens before me are exactly alike. When such a variability exists it is difficult to couple individuals into supposed sexually dimorphic pairs, but I still think that the example given on text-fig. A, no. 3 is a true one. The ornamentation appears very early, but it is also highly variable with regard to the relief of the ribs. The inner ribs are prorsiradiate with exaggerated bullae which become stronger and stronger towards the aperture. The outer ribs are rursiradiate, moderately dense and strong, irregular, each being surmounted by a clavus. The spiral groove, deep and conspicuous in some individuals, is hardly visible in others. The umbilicus is moderately open, but the umbilical walls which are high

and vertical on the inner whorls, fade at the aperture, the lateral walls sloping towards the umbilical seam. The wide and keeled venter is square-shouldered, but the keel fades towards the aperture, with the venter becoming rounded.

Comparisons. Although highly variable, the species is well differentiated and it is difficult to confuse it. *O. (P.) ziegléri*, which is a close species, is smaller, with denser ribbing, the inner ribs never developing exaggerated bullae. There are no other close species.

Distribution. The species seems to be restricted to the Subcontractus Zone. For the locality and age of the holotype see under "Type" above. In England the species has been found in the Fuller's Earth Rock (Subcontractus Zone) at Thornford (Dorset) and also in unzoned Fuller's Earth at Doultling (Somerset). In Bulgaria many specimens of this species have been collected from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones), near the village of Prevala (Michailovgrad).

***Oecotraustes (Paroecotraustes) collignoni* sp. nov.**

Pl. VII, fig. 1

1958. *Oecotraustes serrigerus* Waag.; Collignon, pl. X, figs. 54, 54a.

Type. The species is named after the French palaeontologist Gen. M. Collignon. The holotype was found in Upper Bathonian sediments (the *Histicoides* Zone of Collignon, 1958) in a section near Andranomantasy II (Diego Suarez), Madagascar. Dimensions of the holotype as measured on the original: max. diam. 36 mm. (the aperture is not preserved); at 25 mm.: 12.0 mm. (0.47), 7.0 mm. (0.28), 6.0 mm. (0.24); at 35 mm.: 17.0 mm. (0.48), 10.0 mm. (0.28), 8.0 mm. (0.23). Type series — 1 specimen. The holotype is kept in the collection of Gen. M. Collignon, Isère, France (locality no. 870-B).

Description. The Madagascar holotype is the sole known specimen. This is a medium sized *Oecotraustes (Paroecotraustes)* with progressively higher whorls, which are almost regularly coiled. The inner ribs are prorsiradiate, dense for this subgenus and highly irregular, being somewhat grouped in pairs. The outer ribs are slightly rursiradiate and arched, each one being surmounted on the ventrolateral edge by a claviform node. The characteristic feature of this species is that each of the inner ribs gives rise to only one outer rib. While the inner ribs are often coupled, the outer ones are regularly spaced. The spiral groove is distinct but very narrow and shallow. The umbilicus is small for the subgenus and is surrounded by moderately low and vertical umbilical walls and a distinct but blunt umbilical edge. The fastigate venter is comparatively wide, with a well differentiated keel which remains strong up to the end of the preserved part of the specimen.

Comparisons. There are no species for which *O. (P.) collignoni* could be mistaken. *O. (P.) serrigerus* is smaller, has a different style of ribbing and possesses a wider umbilicus.

Distribution. For the locality and age of the holotype, the sole known individual of this species, see under "Type" above.

Subgenus **Pseudoecotraustes** subgen. nov.
(Khimshiashvilli & J. Stephanov)

Nomenclature. The type species of this new subgenus is *Oecotraustes* (*Pseudoecotraustes*) *bifurcus* sp. nov. (Khimshiashvilli & J. Stephanov).

Diagnosis. The sole known species is small (about 30 mm. when adult) with a moderately wide umbilicus (± 25). The venter is fastigate and ribbed, with small chevrons. The ribbing is falcate and dense, every rib bifurcates on the ventrolateral edge and the new secondary ribs curve strongly forward across the venter forming the chevrons mentioned above. The spiral groove is slightly developed. Upper Bathonian or Lower Callovian (the age is not accurately known).

Comparisons. The ribbed venter with small chevrons on the keel clearly distinguish this subgenus from the other subgenera of the genus *Oecotraustes*.

***Oecotraustes* (*Pseudoecotraustes*) *bifurcus* sp. nov.**
(Khimshiashvilli & J. Stephanov)

Pl. II, fig. 10

Type. The species has characteristically bifurcate ribs on the ventrolateral edge which gave the species its name. The holotype (pl. II, fig. 10) was found by Dr. N. G. Khimshiashvilli near the village of Tsessi (Ambrolauri, Great Caucasus), Georgia, USSR, in sediments whose age is not well localised (Upper Bathonian or Lower Callovian), but it seems to me that these are most probably of Upper Bathonian age. Dimensions of the holotype as measured on the original: max. diam. 28 mm. (with the base of the lateral lappets preserved); at 22 mm.: 9.2 mm. (0.42), —, 5.5 mm. (0.25); at 28 mm.: 12.5 mm. (0.45), —, 7.0 mm. (0.25). Type series — 1 Georgian specimen. The holotype is kept in the Museum at the Palaeobiological Institute, Georgian Academy of Sciences, Tbilisi (Coll. N. G. Khimshiashvilli).

Description. This is a rare, small species which is regularly coiled. The ornamentation consists of thin dense falcate ribs, the inner parts of which are prorsiradiate, while the outer parts are rursiradiate and arched, becoming slightly enlarged on the ventrolateral edge. Here, instead of nodes or clavi, the ribs suddenly bifurcate and the secondary ribs curve strongly forwards over the carinate venter forming small chevrons on the keel at this point. The shell is preserved over a considerable part of the last whorl and shows numerous striae on the ribs and in the spaces between them that follow the direction of the ribs. The spiral groove is clear but narrow and weak, and coincides with the change of direction of the ribs, the latter showing characteristically greater relief here. The umbilicus is moderately open, surrounded by moderately high and steep umbilical walls, the umbilical edge being distinct but rounded. The venter is narrow, fastigate and with small chevrons.

Comparisons. There are no close species with which *O. (P.) bifurcus* could be confused.

Remarks. No Oppeliids are known up to the present which possess such ventral chevrons, though genera of other subfamilies, outside

the Opeletiinae, show large variability in crenulate or toothed venters. The chevrons of this species are, however, of a different style and result from an evolutionary phenomenon, similar to that which produced the chevrons in the Amaltheidae and Cardioceratidae (see Howarth, 1958—1959; Arkell, 1939 and 1950). The descendants of *O. (P.) bifurcus* (if any) remain unknown, however.

Distribution. This is given in the notes under "Type" above.

Subgenus **Thraxites** subgen. nov.

Nomenclature. The type species of this new subgenus is *Oecotraustes (Thraxites) thrax* sp. nov.

Diagnosis. Small (± 30 —40 mm. when adult) with moderately open (± 0.25) to wide (± 0.40) umbilicus. Venter fastigate and smooth. Ribbing sygmodal or falcate on the phragmocone, suddenly changing on the beginning of the body chamber, the outer ribs becoming more or less widely spaced with strong exaggerated ventrolateral clavi. No spiral groove, but the direction of ribbing is well expressed. Upper Bathonian — Middle Callovian.

Comparisons. *Oecotraustes (Oecotraustes)* do not possess outer ribs which suddenly become widely spaced with strongly exaggerated ventrolateral clavi. *Paroecotraustes* have angular ribs and a more or less distinct spiral groove. *Pseudoecotraustes* have a ribbed venter and small chevrons on the keel.

***Oecotraustes (Thraxites) haemussensis* sp. nov.**

Pl. II, figs. 7—8

Type. The species is named after the ancient name Haemuss of the recent Balkan Mountains. The holotype (pl. II, fig. 7) was found in the Polaten Limestones (Serrigerus Bed; "Retrocostatum" Zone) near the village of Glojane (Teteven), Bulgaria. Dimensions of the holotype as measured on the original: max. diam. 30 mm. (the aperture is not preserved); at 20 mm.: 9.0 mm. (0.45), 6.0 mm. (0.30), 5.5 mm. (0.27); at 30 mm.: 13.0 mm. (0.43), 7.0 mm. (0.23), 8.0 mm. (0.27). Type series — 2 Bulgarian specimens. The holotype is kept in the Museum at the Geological Institute, Bulgarian Academy of Sciences, Sofia (Coll. BAN, no. J606).

Description. A small and strongly elliptically coiled species whose ornamentation appears early on the last whorl but one. It consists of slightly angular ribbing, the inner and outer ribs being similar in strength. Each inner rib, however, shows a slight thickening on the umbilical edge and each outer rib ends on the ventrolateral edge in a small nodule. On the body chamber the style of the ribbing suddenly changes, the inner ribs being transformed into strong but short prorsiradiate bullae, while the outer ribs become widely spaced, strong, straight and almost radial. On the ventrolateral edge each outer rib ends in a strong clavus. A characteristically smooth space here exists between the inner bullae and the outer ribs. The umbilicus is moderately wide and is surrounded by sloping umbilical walls and an extremely rounded umbilical edge. The venter, keeled and fastigate

on the phragmocone, becomes almost tabulate with a small keel and marked ventrolateral edges, which are formed by the rows of the ventrolateral clavi of the outer ribs.

Comparisons. There are no close species for which *O. (T.) haemussensis* could be mistaken.

Distribution. The species occurs in the "Retrocostatum" Zone. For the locality and age of the holotype see under "Type" above. The other Bulgarian paratype was found in unzoned Upper Bathonian sediments near the village of Gintsi (Sofia).

***Oecotraustes (Thraxites) davitashvili* sp. nov.**

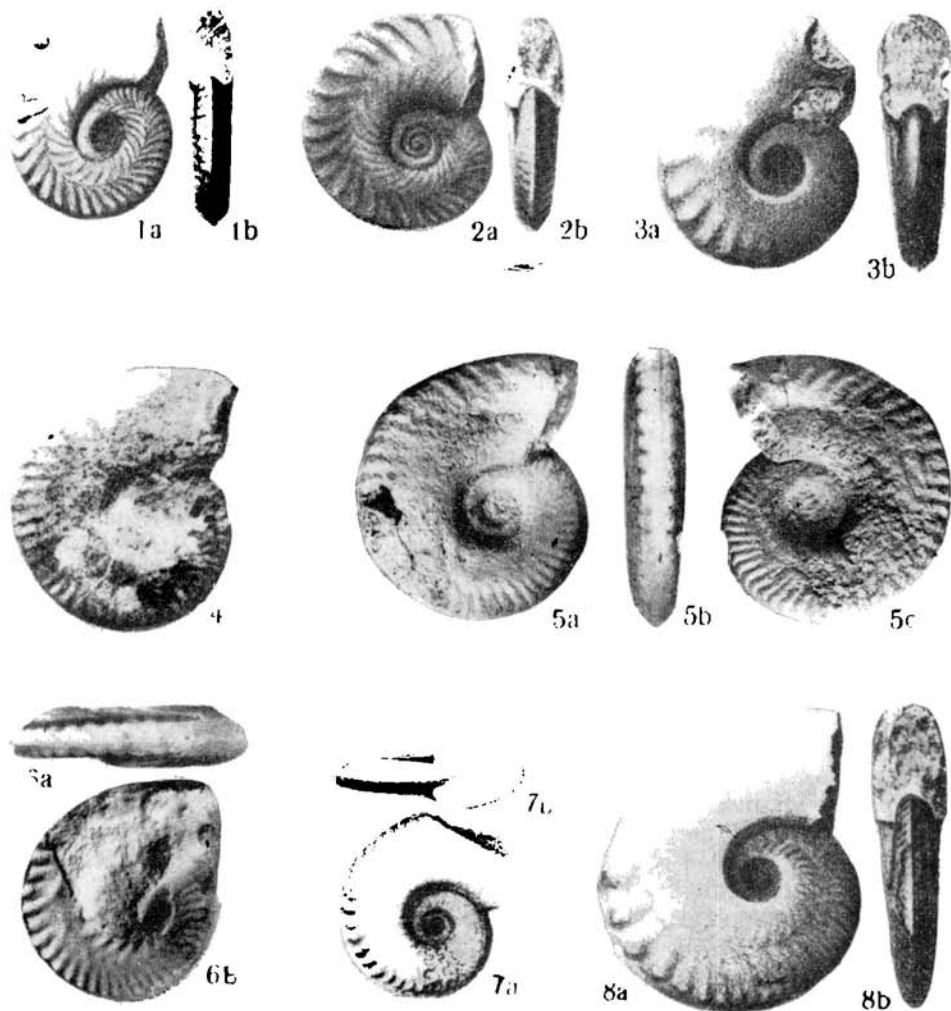
Pl. II, fig. 9

Type. The species is named after the Georgian palaeobiologist L. Sh. Davitashvili. The holotype (pl. II, fig. 9) was found in the Nodigera Bed (Macrocephalus Zone) near the village of Mitrovtsi (Michailovgrad), Bulgaria. Dimensions of the holotype as measured on the original: max. diam. 36 mm. (at broken aperture); at 36 mm.: 13.0 mm. (0.36), 9.0 mm. (0.25), 15.0 mm. (0.41). Type series — 1 Bulgarian specimen. The holotype is kept in the Museum at the Geological Institute, Bulgarian Academy of Sciences, Sofia (Coll. BAN, no. J1023).

Description. The holotype is the sole known specimen and is, unfortunately, incomplete, a part of its whorls being broken and absent. The specimen shows, however, characteristic features which make me name it. This is a medium sized, very evolute and slightly elliptically coiled *Oecotraustes (Thraxites)* which is septate to 25 mm. The inner whorls are entirely deprived of ornamentation. The last whorl shows widely spaced, slightly rursiradate, distinct outer ribs, each one being surmounted on the ventrolateral edge by a small but distinct clavus. Towards the aperture the ribs and the clavi suddenly fade, but do not wholly disappear, persisting to the end of the incomplete last whorl as rib-like undulations very low in relief. The inner part of the last whorl is smooth. The umbilicus is extremely wide, the umbilical walls are very low and vertical, the umbilical edge, being very rounded, is not clear. The venter is moderately wide and keeled, but the keel decreases and entirely disappears from the beginning of the body chamber, making the venter rounded.

Comparisons. There are no close named species with which *O. (T.) davitashvili* could be mistaken. *Horioceras depereti* Lemoine (Lemoine, 1932, pl. XXIV, figs. 1—11) which seems to me to be an *Oecotraustes (Thraxites)* is comparable, but differs in having only 6—8 strong and extremely widely spaced ventrolateral clavi and, besides, it is more involute. *O. (T.) conjungens*, on the other hand, possesses much denser ribbing and also thin inner ribs that are described in Mayer's text but are not visible in his picture (1865, pp. 322—323, pl. VIII, fig. 6).

Distribution. Macrocephalus Zone. For the locality and age of the holotype which is the sole known specimen see under "Type" above.



Text-fig. B. 1a, b — *Oecotraustes* (*Paroecotraustes*) *subfuscus* Waagen. Holotype (lost); reproduction of the original figure of Waagen [1869, pl. XX (5), figs. 6a, b]; the specimen is from Lower Bathonian sediments containing a Zigzag Zone fauna (according to the present classification) from St. Pezenne near Niort (Deux-Sèvres), France, 2a, b — *Oecotraustes* (*Paroecotraustes*) *serrigerus* Waagen. Lectotype designated by Lissajous (1923, p. 120) (lost); reproduction of the original figure of Waagen [1869, pl. XX (5), figs. 7a, b]; the specimen is from Upper Bathonian sediments that were thought by Waagen to contain his Aspidoides Zone fauna (probably whole Upper Bathonian of present classification) from Balin (Cracow), Paland. 3a, b — *Oecotraustes* (*Paroecotraustes*) *waageni* J. Stephanov. Holotype (lost); reproduction of the original figure of Waagen [1869, pl. XX (5), figs. 8a, b]; the specimen is from Upper Bathonian sediments that were thought by Waagen to contain his Aspidoides Zone fauna (probably whole Upper Bathonian of present classification) from Balin (Cracow), Poland. 4 — *Oecotraustes* (*Paroecotraustes*) *densicostatus* Lissajous. Lectotype here designated (lost); reproduction of the original figure of Lissajous (1923, pl. XXVI, fig. 6); the specimen is from Bathonian sediments (see p. 53 of this page.) near Davayé (Mâcon), France. 5a, b, c — *Oecotraustes* (*Paroecotraustes*) *densicostatus* Lissajous; the specimen is from unzoned Bathonian sediments of a locality in the Minor Caucasus Mountains near the village of Novo-Saratovka (river Dzegamchayi), Azerbaidgan, USSR (Coll.

Oecotraustes (Thraxites) conjungens (Mayer)

Text-fig. B, no. 7

1865. *Ammonites conjungens* Mayer, p. 322, pl. VIII, fig. 6.
non 1869. *Oecotraustes conjungens* K. Mayer; Waagen, p. 232(54), pl. XX(5), figs. 5a, b, c [= *O. (T.) thrax*].
non 1888. *Ammonites conjungens* May.; de Grossouvre, p. 377, pl. IV, figs. 1a, b.
non 1888. *Oecotraustes conjungens* (K. Mayer); S. Buckman, pl. XX, figs. 13—14 [= *O. (O.) nodifer*]; and figs. 15—17 [= *O. (O.) costiger*].
non 1915. *Oppelia (Oecotraustes) conjungens* Waagen (non Mayer); Lóczy, p. 337, pl. III, figs. 8—9; text-figs. 62—64.
non 1930. *Paroecotraustes conjungens* (Mayer); Sapth, p. 29, pl. II, figs. 9a—c.
non 1935. *Oppelia conjungens* Waagen; Passendorfer, p. 95, pl. IV, fig. 8.
non 1956. *Oppelia (Oecotraustes) conjungens* Waag; Sachariewa-Kowatschewa, p. 254, pl. XI, fig. 6.

Type. The lectotype here designated is the specimen figured by Mayer (1965, pl. VIII, fig. 6). It was found in Callovian sediments near Echningen (Württemberg), Germany, that contain a *Macrocephalus* Zone fauna (sensu Mayer, 1865; for discussion of the age of the Echningen Callovian see in Arkell, 1956a, p. 119). Which of the two syntypes is the one of which measurements are given by Mayer (1865, p. 322; see the Latin text), is not stated, although it seems that the figured specimen has, in fact, been measured. To avoid further confusion I am not using here either the above dimensions, or dimensions measured on Mayer's illustration (see synonymy). Both lectotype and paralectotype according to the kind information of Dr. B. Ziegler, must be considered as lost. The species needs, therefore, a neotype designation.

Description. The original characteristics and picture of the lateral and ventral views of the lectotype given by Mayer (see synonymy) seems to define the species satisfactorily. This is a rare, small, almost regularly coiled *Oecotraustes (Thraxites)*, whose ornamentation consists of very fine sygmoidal ribs, described by Mayer (1865, pp. 322—323) as "... petites côtes assez distantes, en forme de \vee très-ouvert...", but which are not visible on this illustration on pl. VIII, fig. 6. At the beginning of the body chamber the ribs are somewhat farther apart, each ending on the ventro-lateral edge in a small but distinct node. The whole ornamentation suddenly fades towards the aperture, but, probably, does not completely disappear. The umbilicus is moderately wide for the subgenus. The venter is fastigate

M. R. Abdulkassumzade. 6a, b — *Oecotraustes (Paroecotraustes) zieglerei* sp. nov. Paratype; the specimen is from unzoned Bathonian sediments near the village of Tonashen (Minor Caucasus Mountains). Azerbaidgan, USSR (Coll. T. A. Gassanov). 7a, b — *Oecotraustes (Thraxites) conjungens* (Mayer). Lectotype here designated (lost); reproduction of the original figure of Mayer (1865, pl. VIII, fig. 6); the specimen is from Lower Callovian sediments that contain a *Macrocephalus* Zone fauna (sensu Mayer, 1865; discussion of the age of the Echningen Callovian see in Arkell, 1956a, p. 119); the locality is near Echningen (Württemberg), Germany. 8a, b — *Oecotraustes (Thraxites) thrax* sp. nov. Holotype (St. Sig. f. Paläont. u. hist. Geol., München, coll. Mü., AS I 519); reproduction of the original figure of Waagen [1869, pl. XX(5), figs. 5a, b]; the specimen is from Lower Callovian sediments containing a *Macrocephalus* Zone fauna (sensu Waagen, 1869; discussion of the age of the Balin Oolite see in Rózycki, 1953, pp. 242—245, 383—384 and Arkell, 1956a, pp. 480—482); the locality is Balin (Cracow), Poland. All specimens natural size, with the exception of that on fig. 4 which is slightly enlarged; figs. 5—6 — casts; photo — D. Baklov.

but the keel decreases towards the aperture, the venter becoming rounded here.

Comparisons. *O. (T.) thrax* is larger, more or less elliptically coiled, much more involute and possesses angular ribbing. *O. (T.) davitashvilii* is also larger, much more evolute and possesses only outer ribs that are much more widely spaced than the same of *O. (T.) conjungens*. No other named close species exist.

Distribution. For the locality and age of the lectotype and paralectotype see under "Type" above.

Oecotraustes (Thraxites) thrax sp. nov.

Text-fig. B, no. 8

1869. *Oecotraustes conjungens* K. Mayer; Waagen, p. 232 (54), pl. XX (5), figs. 5 a, b, c.

Type. The species is named after the ancient Thracian population of the Balkan Peninsula. The holotype is the specimen of Waagen [1869, pl. XX (5), fig. 5]. It was found in sediments that contain a *Macrocephalus* Zone fauna (sensu Waagen; discussion of the age of the Balin Oolite see in Różycki, 1953, pp. 242—245, 383—384 and Arkell, 1956a, pp. 480—482); the locality is near the village of Balin (Cracow), Poland. Dimensions of the holotype according to the original: max. diam. 42 mm. (the aperture is not preserved); at 42 mm.: 17.0 mm. (0.40), 10.0 mm. (0.24), 11.0 mm. (0.26). Type series — 1 specimen. Dr. P. Wellnhofer kindly searched and found the holotype in the Bayerische Staatssammlung für Paläontologie und historische Geologie, Munich (Coll. Mü., no. AS I 519).

Description. A medium sized and rather rare *Oecotraustes (Thraxites)*. The ribbing on the phragmocone is extremely weak and consists of falcate and very dense ribs that end at the ventrolateral edge without forming nodes or clavi. At the very beginning of the body chamber, however, the ribbing suddenly changes: the inner prorsiradiate parts of the falcate ribs disappearing entirely, while their outer rursiradiate parts become widely separate, ending on the ventrolateral edge in strongly exaggerated clavi. The latter are about 8 in number and towards the aperture these suddenly disappear. Thus the lateral walls of the body chamber continue entirely smooth up to the end of the conch. No spiral groove, but the change in direction of the ribs is quite distinct. The umbilicus is moderately open and is surrounded by vertical umbilical walls comparatively high for the subgenus and by a characteristically sharp umbilical edge. The venter is narrow and keeled, but the keel fades as the ventral clavi disappear, with the venter becoming gradually more rounded.

Comparisons. *O. (T.) conjungens* is smaller, more evolute and possesses sygmoidal ribbing. There are no other named species with which *O. (T.) thrax* could be confused.

Distribution. For the locality and age of the holotype see under "Type" above.

Twenty seven species are described in the present paper, but these do not exhaust the specific content of the genus. Several new Bulgarian species remain unnamed because of material either fragmentary, crushed, worn, or otherwise unsuitable for naming. Several new foreign species (English, Rumanian, Azerbaidgian, etc.), whose original specimens or casts were kindly sent to me by friends, were left to be named by their collectors. Further, colleagues wrote to me that a number of new species of their own collections, not seen by me, will be named and published in the near future. Thus, the genus *Oecotraustes* may embrace about 40 species — 27 nominal and about 13 potential ones. However, I believe that this is not the end and new further species, whose existence might now only be suspected, will be discovered, carefully studied, named and published in the future.

Besides, below I am discussing several species which remain uncertain, as far as I am concerned, (1) whether they belong to this genus or not; (2) whether they are separate species or are their names junior subjective synonyms of previously named species. These are:

1. *Oecotraustes minor* Parona (1896, p. 15, pl. I, figs. 12 a, b). The illustration of this Bajocian species (Humphriesianum and Subfurcatum Zones; see Sturani, 1964, pp. 22—34) cannot suggest a definite opinion, but I discussed *Oecotraustes minor* with Dr. C. Sturani, who kindly wrote to me that it is a species which was based on immature specimens. The latter, according to him, are comparable with nuclei of the genus *Oppe- lia* (ex. gr. *subradiata*) or of *Oecotraustes genicularis*. I am more inclined to agree with the first of Dr. Sturani's above two suppositions, but I would also add and emphasize that the picture of *Oecotraustes minor* (if correct) is very close to, and is congeneric with, the specimen described and photographically reproduced by Krimholz & Stankevich as *Oecotraustes nodifer* (1963, the plate, fig. 8), which in my opinion is a new subgenus of the genus *Cadomoceras* Munier-Chalmas, 1892. *Oppe- lia vicetina* Parona (1896, p. 13, pl. I, fig. 10) mentioned by Sturani (1964, p. 25) as "*Oecotraustes vicetinus* (Parona)" do not belong to the genus *Oecotraustes*.

2. *Oecotraustes angustus* H. Douvillé [1916, p. 15, pl. III, figs. 6 a, b; described in the text as *Oppe- lia (Oecotraustes) angusta*]. The photographically reproduced lateral and ventral views of this Oppe- liid from the Upper Bajocian (Subfurcatum Zone; see Arkell, 1952, p. 297; Arkell & Lucas, 1953; Farag, 1959, p. 179) suggest an *Oecotraustes*. The species resembles, and is probably even conspecific with, *Oecotraustes (Paroecotraustes) sub- fuscus*, which is a species from the Zigzag Zone; however, many reasons exist against such a subordination. *Oecotraustes angustus* needs re-study: its holotype must be found in the collections and described in modern terms (I believe that it is not lost) and also new topotypes must be collected, if possible.

3. *Oppe- lia skrodzkyi* Brasil [1895, p. 41, pl. III, fig. 14 (photograph) and fig. 15 (drawing)]. The photographically reproduced lateral view of this Oppe- liid from the Upper Bajocian (mixture of Garantiana and Subfurcatum Zones; see Arkell, 1956a, p. 50) resembles an *Oecotraustes* in lateral view. However, Brasil pointed out in his text that "Les côtes passent sur la région siphonale où elles se raccordent avec les côtes venant de l'autre face,

en formant des arcs saillants à concavité dirigée vers l'ouverture". In addition, the conch is described as "non carénée" and the drawing (if correct) of the whorl sections of the last and last but one whorls shows a rounded venter, indeed. These features suggest that *Oppelia skrodzkyi* does not belong to any of the known subgenera of *Oecotraustes*. The subgenus *Oecotraustes* (*Pseudoeotraustes*), which is an Upper Bathonian or even early Callovian subgenus, shows a ribbed but fastigate venter which is not comparable with the venter of *Oppelia skrodzkyi*. Re-study of this species is needed, but in any case it does not belong to *Oecotraustes*.

4. *Oekotraustes binodosus* Simionescu (1905, p. 17, pl. III, figs. 5a, b). The illustration of this Oppeliid suggests a true *Strungia* Arkell, 1952, from the Upper Bathonian, and is a junior subjective synonym of *Strungia redlichi* (Popovici-Hatzeg) (see Patruilus, 1957, p. 262).

5. *Horioceras depereti* Lemoine (1932, p. 482, pl. XXIV, figs. 1—11; fig. 2 is the holotype). The photographically reproduced specimens of the type series suggest an *Oecotraustes* (*Thraxites*), which is probably conspecific with the specimens figured as "*Oppelia* (*Oekotraustes*) *conjungens*" by Łóczy (1915, pl. III, figs. 8—9). Re-study of *Horioceras depereti* is also urgently needed. Lemoine's other *Horioceras* (1932, pl. XXIV, figs. 12 and 12a) is a true *Distichoceras*: *Distichoceras concinnum* (Lemoine).

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PLATE I

- a, b, c. *Oecotraustes (Oecotraustes) genicularis* Waagen. Lectotype. The specimen is found in Upper Bajocian sediments at Sully near Bayeux (Normandy), France; original of Waagen [1869, pl. XX(5), fig. 4] and Westermann (1958, pl. 1, fig. 1). St. Slg. f. Paläont. u. hist. Geol., Munich (Coll. Mü., AS I 521).
2. *Oecotraustes (Oecotraustes) bomfordi* Arkell. Holotype. The specimen is from the Zigzag Bed (Zigzag Zone), Powerstock Station quarry (Dorset), England; original of Arkell (1951c, pl. VII, fig. 12). Sedgwick Museum, Cambridge (SM. J29002).
3. *Oecotraustes (Oecotraustes) bomfordi* Arkell. Paratype. The specimen is from the Zigzag Bed (Zigzag Zone), Powerstock Station quarry (Dorset), England; original of Arkell (1951c, pl. VII, fig. 11). Sedgwick Museum, Cambridge (SM. J29007).
- 4a, b, c. *Oecotraustes (Oecotraustes) westermanni* sp. nov. Holotype. The specimen is from early Upper Bajocian sediments in the section "Hontoria II" near Burgos, Spain; original of Westermann (1958, pl. 1, fig. 4). Mus. Geol. Bundesanstalt für Bodenforschung, Hannover (Coll. Hann., no. b301).
- 5a, b. *Oecotraustes (Oecotraustes) costiger* S. Buckman. The specimen is from a locality in Shipton Gorge (Dorset), England, from Parkinsoni Zone (Bomfordi Subzone) (Coll. H. S. Torrens, no. 2730).
- 6a, b, c, d. *Oecotraustes (Oecotraustes) costiger* S. Buckman. Lectotype. The specimen is from the lower part of the Crackment Limestones (Parkinsoni Zone, Bomfordi Subzone), Bradford Abbas (Dorset), England; original of S. Buckman (1888, pl. XX, figs. 15—16) and Arkell (1951c, pl. VII, fig. 6). Sedgwick Museum, Cambridge (SM. J6418).
- 7a, b, c. *Oecotraustes (Oecotraustes) costiger* S. Buckman. Paralectotype. The specimen is from the lower part of the Crackment Limestones (Parkinsoni Zone, Bomfordi Subzone), Bradford Abbas (Dorset), England; original of S. Buckman (1888, pl. XX, fig. 17) and Arkell (1951c, pl. VII, fig. 5). Sedgwick Museum, Cambridge (SM. J6419).

All specimens natural size; all specimens were whitened with NH_4Cl before the photographing; photo — D. Baklov; fig. 5 — original, figs. 1—4 and 6—7 — casts.

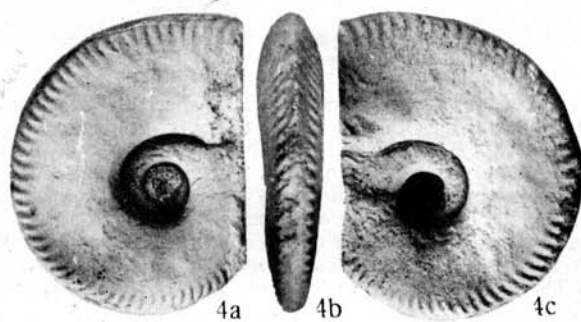
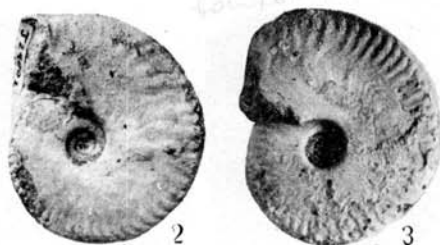
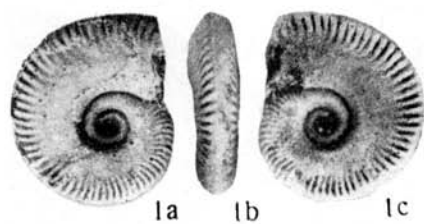


PLATE II

1. *Oecotraustes (Oecotraustes) bradleyi* Arkell, Paratype. The specimen is from the Zigzag Bed (Zigzag Zone), Powerstock Station quarry (Dorset), England; original of Arkell (1951c, pl. VII, fig. 2). Sedgwick Museum, Cambridge (SM. J29003).
- 2a, b. *Oecotraustes (Oecotraustes) bradleyi* Arkell. Holotype. The specimen is from the Zigzag Bed (Zigzag Zone), Powerstock Station quarry (Dorset), England; original of Arkell (1951c, pl. VII, fig. 1). Sedgwick, Museum, Cambridge (SM. J29004).
- 3a, b. *Oecotraustes (Oecotraustes) nodifer* S. Buckman. The specimen is from the Coarse Oolite Horizon (condensed Zigzag — Subcontractus Zones) at the village of Dolny Lom (Vidin), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J1024).
- 4a, b, c. *Oecotraustes (Oecotraustes) nodifer* S. Buckman. Holotype. The specimen is from the lower part of the Crackment Limestones (Parkinsoni Zone, Bomfordi Subzone), Bradford Abbas (Dorset), England; original of S. Buckman (1888, pl. XX, figs. 13—14) and Arkell (1951c, pl. VII, fig. 8). Sedgwick Museum, Cambridge (SM. J6417).
- 5a, b, c. *Oecotraustes (Oecotraustes) bakalovi* sp. nov. Holotype. The specimen is from the Polaten Limestones (Serrigerus Bed; "Retrocostatum" Zone) near the village of Glojane (Teteven), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J588).
6. *Oecotraustes (Oecotraustes) bakalovi* sp. nov. Paratype. The specimen was found in strata that contain a "Retrocostatum" Zone fauna in a section at the village of Dolna Riksa (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J598).
- 7a, b, c. *Oecotraustes (Thraxites) haemussensis* sp. nov. Holotype. The specimen is from the Polaten Limestones (Serrigerus Bed; "Retrocostatum" Zone) near the village of Glojane (Teteven), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J606).
8. *Oecotraustes (Thraxites) haemussensis* sp. nov. Paratype. The specimen was found in unzoned Bathonian sediments near the village of Gintsi (Sofia), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J590).
- 9a, b, c. *Oecotraustes (Thraxites) davitashvili* sp. nov. Holotype. The specimen is from Nodigera Bed (Macrocephalus Zone) near the village of Mitrovtsi (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J1023).
- 10a. a. *Oecotraustes (Pseudoeocotraustes) bifurcus* sp. nov. (Khimshiashvili & J. Stephanov). Holotype. The specimen is from sediments whose age is thought to be Upper Bathonian or Lower Callovian, but it seems that these have an Upper Bathonian age; the locality is near the village of Tsessi (Ambrolauri, Great Caucasus), Georgia, USSR. Mus. Palaeobiol. Inst., Georg. Acad. of Sci., Tbilissi (Coll. N. G. Khimshiashvili).

All specimens natural size; all specimens were whitened with NH_4Cl before the photographing; photo — D. Baklov; figs. 1—2, 4 and 10 — casts; figs. 3 and 5—9 — originals.

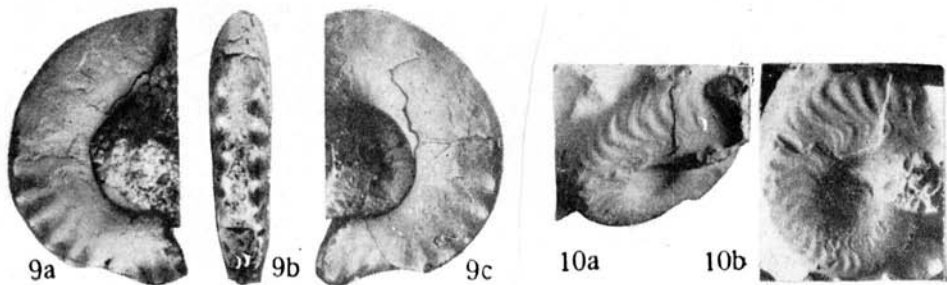
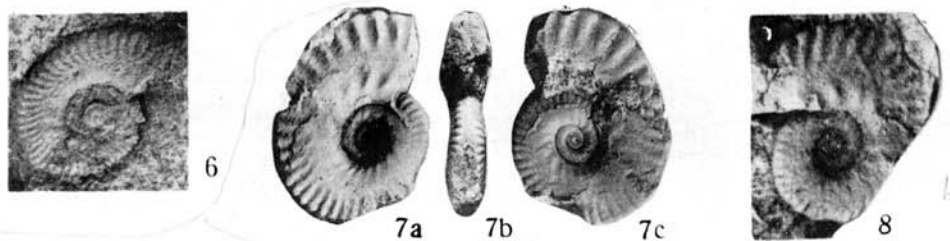
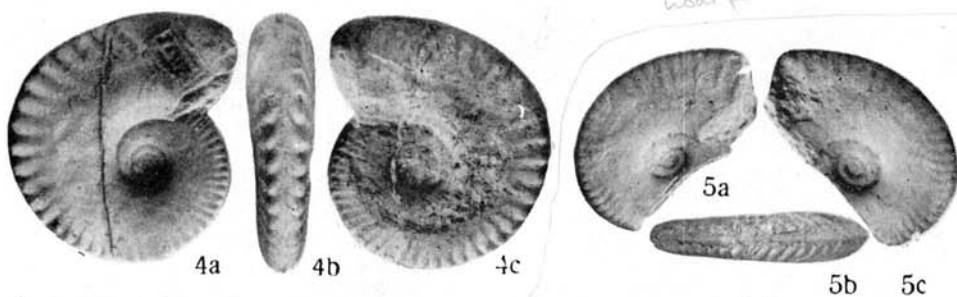
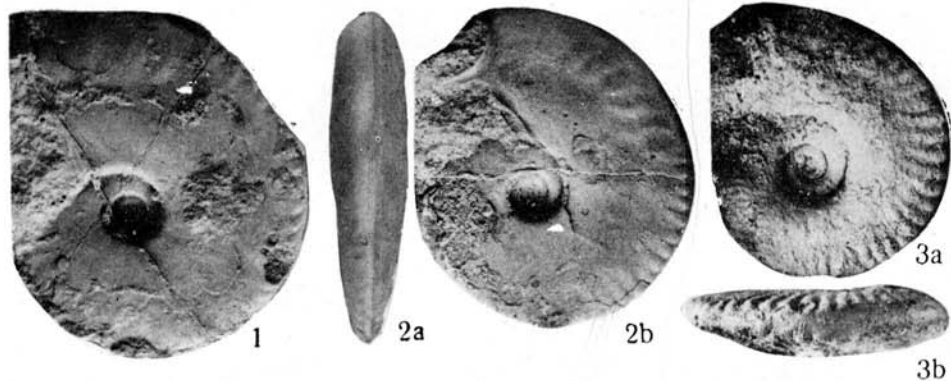


PLATE III

1. *Oecotraustes* (*Paroecotraustes*) *formosus* Arkell. Holotype. The specimen is from the Aspidoides Beds (condensed Subcontractus — Morrisi Zones), Holz-Berg near Schwandorf (Oberpfalz), Germany; original of Arkell (1951b, pl. I, fig. 4) and Arkell (1951c, text-fig. 18, no. 2). Polytech. Mus., Zürich (Coll. L. Krumbeck).
2. *Oecotraustes* (*Paroecotraustes*) *formosus* Arkell. Paratype. The specimen is from the Aspidoides Beds (condensed Subcontractus — Morrisi Zones), Holz-Berg near Schwandorf (Oberpfalz), Germany; original of Arkell (1951b, pl. I, fig. 5) and Arkell (1951c, text-fig. 18, no. 3). Polytech. Mus., Zürich (Coll. L. Krumbeck).
- 3—8. *Oecotraustes* (*Paroecotraustes*) *formosus* Arkell. Topotypes. Specimens from the Aspidoides Beds (condensed Subcontractus — Morrisi Zones), Holz-Berg near Schwandorf (Oberpfalz), Germany. Polytech. Mus., Zürich (Coll. L. Krumbeck).
- 9a. b. *Oecotraustes* (*Paroecotraustes*) *waageni* J. Stephanov. Neotype. The specimen is from the Aspidoides Schichten (Aspidoides or "Retrocostatum" Zones) from Lechstedt near Hildesheim (Lower Saxony), Germany; described by Westermann (1958, pl. I, fig. 6) as "*Paroecotraustes* (*Paroecotraustes*) *serrigerus* (Waagen, 1876)" and the original of J. Stephanov (1961b, text-fig. 2). Mus. Geol. Bundesanstalt für Bodenforschung, Hannover (Coll. Hann. no. b302).
- 10a. b. *Oecotraustes* (*Paroecotraustes*) *waageni* J. Stephanov. Paratype. The specimen is from the Aspidoides Schichten (Aspidoides or "Retrocostatum" Zones) from Lechstedt near Hildesheim (Lower Saxony), Germany; described by Westermann (1958, pl. I, fig. 7) as "*Paroecotraustes* (*Paroecotraustes*) *serrigerus* (Waagen, 1876)". Mus. Geol. Bundesanstalt für Bodenforschung, Hannover (Coll. Hann. no. b303).
11. *Oecotraustes* (*Paroecotraustes*) *waageni* J. Stephanov. The specimen is from condensed Upper Bathonian — Lower Callovian sediments from Vadu Crişului, Rumania (Coll. D. Patruşius).
- 12a. b. *Oecotraustes* (*Paroecotraustes*) *serrigerus* Waagen. Neotype. The specimen is from the Polaten Limestones (Serrigerus Bed; "Retrocostatum" Zone) near the village of Glojane (Teteven), Bulgaria; original of J. Stephanov (1961b, text-fig. 1). Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J601).
13. *Oecotraustes* (*Paroecotraustes*) *serrigerus* Waagen. The specimen is from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (BAN, no. J846).

All specimens natural size; all specimens were whitened with NH_4Cl before the photographing; photo — D. Baklov and G. Kirov; figs. 1–2 and 9–10 — casts, figs. 3–8 and 12–13 — originals.



1



2



3a



3b



3c



4c



4a



4b



5



6a



6b



7a



7b



7c



8a



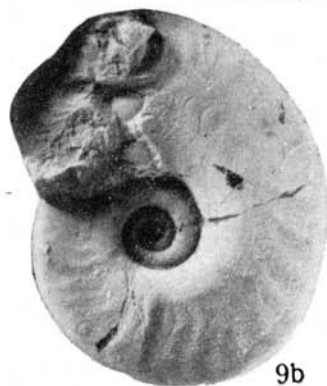
8b



8c



9a



9b



12a



12b



13



10a



10b



11

PLATE IV

- 1a, b. *Oecotraustes (Paroecotraustes) splendens* Arkell. Holotype. The specimen is from Aspidoides Beds (condensed Subcontractus — Morrisi Zones), Holz-Berg near Schwandorf (Oberpfalz), Germany; original of Arkell (1951b, pl. I, fig. 1). Polytech. Mus., Zürich (Coll. L. Krumbeck).
- 2a, b, c. *Oecotraustes (Paroecotraustes) splendens* Arkell. The specimen is from the Fuller's Earth Rock (Subcontractus Zone) near Thornford (Dorset), England; original of Arkell (1951c, pl. VIII, fig. 3). Geol. Surv. & Mus., London (Coll. GSM., no. 73163).
- 3—6. *Oecotraustes (Paroecotraustes) splendens* Arkell. The specimens are from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones), near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, nos. J811, J1062, J812 and J576).
- 7a, b. *Oecotraustes (Paroecotraustes) davaicensis* Lissajous. Lectotype here designated. The specimen is from sediments containing faunas of the "Zone à *Hecticoceras retrocostatum*" of Lissajous (larger than "Retrocostatum" Zone of Torrens, 1965), near Davayé (Mâcon), France; original of Lissajous (1923, pl. XXVI, fig. 9). Mus. Lyon University, Lyon (Coll. M. & B. Lissajous, no. A. 4746).
- 8a, b. *Oecotraustes (Paroecotraustes) laevis* Lissajous. Lectotype here designated. The specimen is from sediments containing faunas of the "Zone à *Hecticoceras retrocostatum*" of Lissajous (larger than "Retrocostatum" Zone of Torrens, 1965), near Fuissé (Mâcon), France; original of Lissajous (1923, pl. XXVI, fig. 7). Mus. Lyon University, Lyon (Coll. M. & B. Lissajous, no. A. 4743a).

All specimens natural size; all specimens were whitened with NH_4Cl before the photographing; photo — D. Baklov; figs. 1—2 and 7—8 — casts, figs. 3—6 — originals.

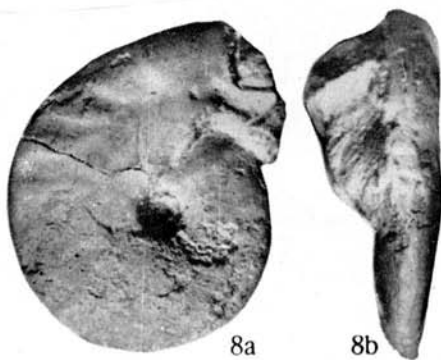
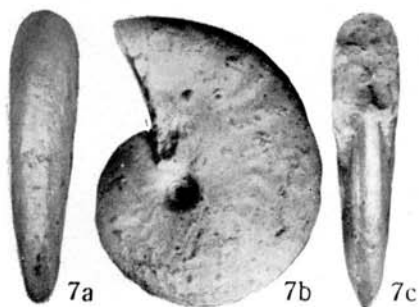
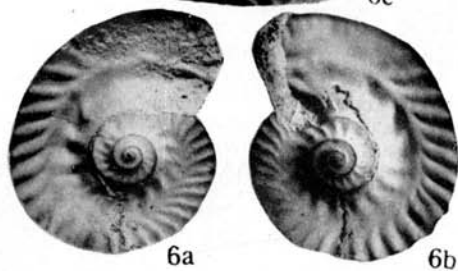
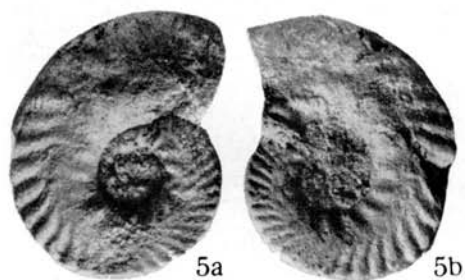
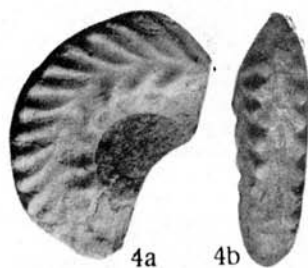
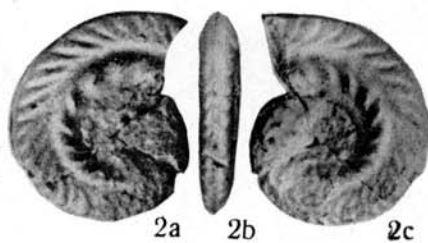
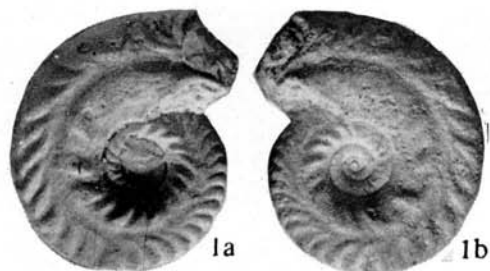


PLATE V

- 1a, b, c. *Oecotraustes* (*Paroecotraustes*) *maubeugei* sp. nov. Holotype. The specimen is from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J581).
- 2a, b, c. *Oecotraustes* (*Paroecotraustes*) *maubeugei* sp. nov. Paratype. The specimen is collected in the upper part of the Rugitela Beds ("Retrocostatum" Zone) in a section at the S. W. corner of Stubbs Wood, Merehead Bridge, near East Cranmore (Somerset), England (Coll. H. S. Torrens, no. 870).
- 3a, b. *Oecotraustes* (*Paroecotraustes*) *maubeugei* sp. nov. Paratype. The specimen is from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J850).
4. *Oecotraustes* (*Paroecotraustes*) *maubeugei* sp. nov. Paratype. The specimen is from Upper Bathonian sediments of a section near the water-source Saka (Bolshoyi Balkhan), Turkmenia, USSR; described by Sibirjakova (1951, pl. V, fig. 12) as "*Oecotraustes* cf. *subfuscus* (Waagen, 1869)". Mus. Vses. N.-Issl. Geol. Inst., Leningrad (Coll. L. V. Sibirjakova, no. 9083 — composite number for the whole collection).
- 5a, b. *Oecotraustes* (*Paroecotraustes*) *maubeugei* sp. nov. Paratype. The specimen is from the Upper Bathonian of an unlocalised locality in France, described by de Grossouvre (1888, pl. IV, fig. 2) as "*Ammonites serrigerus* Waagen". Mus. Sorbonne, Paris.
- 6—7. *Oecotraustes* (*Paroecotraustes*) *maubeugei* sp. nov. Paratypes. The specimens are from the Prevala Beds (Dessivich Oolite Limestones; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, nos. J827 and J574).
- 8a, b, c, d. *Oecotraustes* (*Paroecotraustes*) *paradoxus* J. Roemer. Holotype. The specimen is from the Aspidoides Schichten ("Retrocostatum" Zone) from Lechstedt, near Hildesheim (Lower Saxony), Germany; original of Roemer (1911, pl. VII, fig. 13) and Westermann (1958, pl. 2, fig. 1). Mus. Georg-August University, Göttingen (Coll. Gött., no. Ldt. 41).
- 9a, b, c. *Oecotraustes* (*Paroecotraustes*) *parvus* Westermann. Holotype. The specimen is from the Aspidoides Schichten ("Retrocostatum" Zone) from Lechstedt, near Hildesheim (Lower Saxony), Germany; described by Roemer as "*Oecotraustes paradoxus* n. sp., var." (1911, pl. VII, fig. 14) and original of Westermann (1958, pl. 2, fig. 4). Mus. Georg-August University, Göttingen (Coll. Gött., no. Ldt. 42).

All specimens natural size; all specimens were whitened with NH_4Cl before the photographing; photo — D. Baklov (figs. 4 and 5 were made in Leningrad or Paris); figs. 1—9 — originals.



1a



1b



1c



2a



2b



2c



3a



3b



4



5a



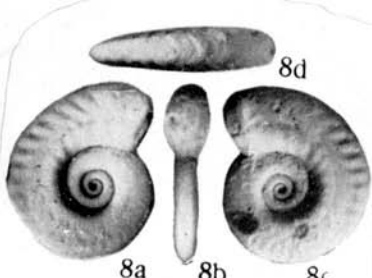
5b



6



7



8a



8b



8c



8d



9a



9b



9c

PLATE VI

- 1a, b. *Oecotraustes (Paroecotraustes) maubeugei* sp. nov. Paratype. Cast of the natural external mould of a specimen from a section near the village of Tsona (Oni, Great Caucasus), Georgia, USSR; Upper Bathonian (probably "Retrocostatum" Zone). Mus. Palaeobiol. Inst., Georgian Acad. of Sci., Tbilissi (Coll. N. G. Khimshiashvili, no. 3407).
- 2—3. *Oecotraustes (Paroecotraustes) maubeugei* sp. nov. Paratypes. The specimens are from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, nos. J832 and J815).
- 4—5. *Oecotraustes (Paroecotraustes) maubeugei* sp. nov. Paratypes. The specimens are from Rugitela Beds ("Retrocostatum" Zone) of Whatley (Somerset), England; mentioned by Arkell (1959, p. 245), as "*Oecotraustes serrigerus* Waagen". Mus. Reading University, Reading (Coll. F. Hodson, nos. 6359 and 6357).
- 6—8. *Oecotraustes (Paroecotraustes) maubeugei* sp. nov. Paratypes. The specimens are from the Prevala Beds (Dessivich Oolite Limestones; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, nos. J837, J838, J836).

All specimens natural size; all specimens were whitened with NH_4Cl before the photographing; photo — D. Baklov; fig. 1 — cast, figs. 2—8 — originals.



1a



1b



2



3



4a



4b



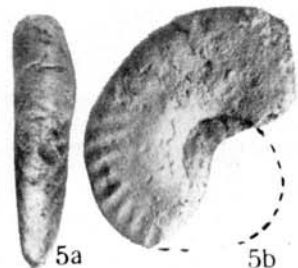
4c



6c



6d



5a



5b



6a



6b



7a



7b



7c



8

P L A T E VII

- 1a, b. *Oecotraustes* (*Paroecotraustes*) *collignoni* sp. nov. Holotype. The specimen is from Upper Bathonian sediments (Histicroides Zone according to Collignon, 1958) in a section near Andranomantasy II (Diego Suarez), Madagascar; described by Collignon (1958, pl. X, figs. 54 and 54a) as "*Oecotraustes serrigerus* Waag." (Coll. Gen. M. Collignon, Isère, France; locality no. 870—B).
- 2a, b, c. *Oecotraustes* (*Paroecotraustes*) *prevalensis* sp. nov. Holotype. The specimen is from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J587).
- 3—4. *Oecotraustes* (*Paroecotraustes*) *prevalensis* sp. nov. Paratypes. The specimens are from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, nos. J586 and J814).
- 5a, b. *Oecotraustes* (*Paroecotraustes*) *prevalensis* sp. nov. Paratype. The specimen is from the Upper Bathonian of an unlocalised locality in France; described by de Grossouvre (1888, pl. IV, fig. 3) as "*Ammonites serrigerus* Waagen". Mus. Sorbonne, Paris.
- 6a, b. *Oecotraustes* (*Paroecotraustes*) *ziegleri* sp. nov. Holotype. The specimen is from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J848).
- 7—8. *Oecotraustes* (*Paroecotraustes*) *ziegleri* sp. nov. Paratypes. The specimens are from the Prevala Beds (Dessivich Oolite Limestone; condensed Subcontractus — "Retrocostatum" Zones) near the village of Prevala (Michailovgrad), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, nos. J579 and J852).
- 9—10. *Oecotraustes* (*Paroecotraustes*) *glojanensis* sp. nov. Paratypes. The specimens are from the Aspidoides Beds (condensed Subcontractus — Morrisi Zones), Holz-Berg near Schwandorf (Oberpfalz), Germany. Polyteck. Mus., Zürich (Coll. L. Krumbeck).
11. *Oecotraustes* (*Paroecotraustes*) *glojanensis* sp. nov. Holotype. The specimen is from the Polaten Limestones (Serrigerus Bed; "Retrocostatum" Zone) near the village of Glojane (Teteven), Bulgaria. Mus. Geol. Inst., Bulg. Acad. of Sci., Sofia (Coll. BAN, no. J605).

All specimens natural size; all specimens were whitened with NH_4Cl before the photographing with the exception of that of fig. 5; photo — D. Baklov (fig. 5 was made in Paris); figs. 1—11—originals.

