

in some cases nothing but the decomposed limestone rock in place, or rather the intercalated impure limestone layers reduced to clay. In other cases the clay has been brought from the neighbourhood into the pot with, or without, lignite. In all cases it is rudely stratified; some of the layers being full of shot ore and ball ore; others being nearly pure white, yellow, or black clay. Usually the quantity of ore increases with the depth; solid floors of ore occur; or the bottom of the pot is filled with solid ore.

Up through this ore-bearing clay-mass rise steeples of pipe ore, the tops of which are struck by the miners at various distances beneath the sod. Some of them projected from the forest-covered soil, as humps of pipe-ore, and led to the discovery of the mine; others were not encountered until the quarry floor had been sunk 10, 20, or 50 feet. But in all cases the pipe-ore mass is a steeple, enlarging downwards with ever-broadening base, and standing finally on the limestone foundation at the bottom of the clay. Oftentimes several steeples unite their bases, like a clump of trees. Some of them have been 100 feet high, and proportionately wide at the base.

The common idea has been that they are concretionary masses, derived from the moist iron-bearing clays.

I have long held that all these limonite deposits have been made in caverns. I now suggest that the broader caverns had their roofs supported (for a time) by masses of stalactite (now removed by erosion) and stalagmite; and that the stalagmite piers have been metasomatized into pipe ore, and remain standing in the surrounding clay.

1008, CLINTON-STREET, PHILADELPHIA,
July 29, 1878.

NOTICES OF MEMOIRS.

AMMONITES OF THE MEDITERRANEAN AND JUVAVIAN TRIAS. By
DR. ED. VON MOJSISOVICS.

[Proceed. Imper. Geol. Instit. Vienna, April 1, 1879.]

(Communicated by Count MARSCHALL, F.C.G.S., etc., etc.)

GENERAL CONSIDERATIONS.

THE forms united in one genus must agree in their least variable characters (disposition and form of the lobes, form and structure of the shell, length of the body-chamber, and form of the margin of the aperture). In continuous genetic series, the limits between the primary genus and those descending (?) from it must necessarily be traced somewhat arbitrarily. Forms or groups of forms, of sporadic occurrence, not possessing indubitable characters of known genera, are generally best considered as constituting independent genera. Isolated forms, notably aberrant in one direction from the generic type, are provisionally ranked among the primary genera.

ARCESTIDÆ.

The genera *Cladiscites*, *Joannites*, and *Sphingites* being eliminated,

the genus *Arcestes*, Suess, comprises the groups of *Extra-labiati*, *Sub-labiati*, *Bi-carinati*, *Coloni*, *Intus-labiati*, *Galeati*, and *Sub-umbilicati*; all of them characterized by more or less modified body-chambers of the full-grown individuals and by a contraction of the umbilicus, frequently occluded by a callosity.

Sphingites, Mojs.—This genus comprises the group of *Co-angustati*, characterized by a widely open umbilicus, prominent ridges, and strictures in the shell of the whorls, including the inhabited chamber, and coarse wrinkled striations. *Cladiscites*, Mojs.—The *Tornati* and *Multilobati* bear a number of characters different from those of the typical *Arcestes*. The constantly closed whorls, of nearly quadrangular transverse section, show neither internal nor external ridges and keep their form even in the last whorl of full-grown individuals. Their lobes offer a peculiar structure. The projection of the preceding whorl coincides with the first auxiliary lobe, not, as in all other *Arcestidæ*, with the second lateral lobe. This is an approximation to the distribution of the lobes of the *Pinacoceratidæ*, and becomes still more conspicuous in *Cladiscites sub-tornatus* by the deepening of the second lateral lobe. Prof. Quenstedt was the first who noticed the peculiar structure of the anti-siphonal lobe with its two many-jointed branches.

Joannites, Mojs.—Like the *Tornati*, the *Cymbiformes* are to be generically separated, as they agree in every respect with *Arcestes* except in the form of their lobes, which is the same as in the genus *Cladiscites*. They are characterized by their arcuate lobe-line.

Didymites, Mojs.

Lobites, Mojs. = *Clydonites*, Laube, = *Coroceras*, Hyatt.

AMALTHEIDÆ.

Ptychites, Mojs.

Amaltheus, Montf.—Triassic forms, standing next to the group of *Fissi-lobati*. The *Amalthei* comprise a number of evidently distinct groups, which may be generically separated.

PINACOCERATIDÆ.

Pinacoceras, Mojs.

Megaphyllites, Mojs.—The group of *Megaphylli*, Beyr. (Type: *Ammonites Tarbas*), differ from *Pinacoceras* in the form of their lobes.

Sageceras, Mojs.

Carnites, Moys.—Comprises *Carnites floridus*, Wulf., *Carn. rari-striatus*, Hauer, and a nondescript species from the Muschelkalk. Very probably this genus is to be connected with *Ceratites Hedenstrœmi*, Keys., or with a form nearly allied to it. The form of the lobes distinguishes *Carnites* from *Pinacoceras*.

Norites, Mojs.—The Triassic species are—*Norites Caprilensis*, Mojs., and *Nor. Gondola*, Mojs. Shell similar to *Sageceras*. Rugose stratum linear. One adventitious saddle of less height than the first primary saddle. Saddles narrow, high, rounded above. Lobes with few indentures, first chief lobe divided by a large indenture. More ancient forms from the sandstones of Artinsk, described by de

Verneuil and Karpinsky, such as *Goniatites cyclobus*, *Gon. post-carbonarius*, and *Gon. præ-permicus*, may be very closely related to *Norites*.

LYTOCERATIDÆ.

Monophyllites.—*Lytoceras spherophyllum* and *Lyt. Morloti* are to constitute a genus distinct from *Lytoceras* on account of the peculiar form of their lobes.

Phylloceras, Suess.

AEGOCERATIDÆ.

Aegoceras, Waag.—This generic denomination may provisionally be reserved for a number of forms from the Mediterranean Muschelkalk, and further researches must decide how far it is to be superseded by that of *Psiloceras*, Hyatt.

TROPITIDÆ.

This family is nearly related to the *Arcestdæ*, and distinguished by a well-developed system of sculpture, and by the length of its inhabited chamber, extending over a whole whorl. The rugose stratum has only been observed in the genus *Halorites*.

Tropites, Moys.—This genus includes the manifold forms allied to *Trop. sub-bullatus*, Hauer; *Trop. Jokelyi*, Hauer; and *Trop. costatus*. Some of these forms show spiral undulated lines similar to those of some *Goniatites*, whose external form reminds us of *Tropites*.

Entomoceras, Hyatt.—The American type of this genus, *Entom. Laubei*, Meek, stands extremely near to the group of *Ammonites Sandlingensis*, Hauer (*Entomoc. Theron*, Dittm., etc.), which group is nearly allied to *Tropites*. It is characterized by a flat compressed shape, a high cultriform carina, aberrant lobes, and, in some cases, by the presence of a number of spines, reminding us of *Trachyceras*. Length of the inhabited chamber still unknown.

Halorites, Mojs.—Includes the group of *Halorites Ramsaueri*, Quenst., characterized by a body-chamber and mode of growth similar to those of *Arcestes*, sculpture like strings of pearls on the inner whorls, and high saddles with many lateral branches. Lateral lobes reduced. Whorl of the inhabited chamber different in shape and sculpture from the inner whorls. Margin of the mouth with a slight stricture. Aberrant forms: *Hal. semi-plicatus*, Hauer; *Hal. decrescens*, Hau.; *Hal. semi-globosus*, Hau.; and *Ammonites Medleyanus*, Stol.

Juvavites, Mojs.—Comprises the groups of *Juv. Ehrlichi*, Hau.; and *Juv. alterni-plicatus*, Hau. Near to *Halorites*; different from this genus by the similitude of the whorl of the inhabited chamber with the inner whorls, and by the lobes being less slitted. Periodical constrictions of the shell are frequent.

Distichites, Mojs.—Convex portion with a channel-like depression in the middle, frequently with smooth carinæ along the margins. Inner whorls, save the double carina, similar in sculpture to those of *Tropites Jokelyi*. Outer whorls gradually flattening; the outer range of spines advancing to the middle of the sides, where also the ribs increase in number by bifurcation and intercalation. Inhabited chamber extending beyond a whorl. Lobes similar to those of

Sagenites. Generic type, *Dist. Celticus*, Mojs. Only a few species, such as *Dist. pseudo-aries*, Hau., and *Dist. Harpalus*, Dtm., are as yet described.

CERATITIDÆ.

This family appears first in the Permians, and reaches, under manifold modifications of form, upwards into the Lower Carnian deposits. The Indian and Armenian forms, described by MM. Koninck, Waagen, and Abich, stand in evident contrast with those typical of our "Werfen" beds, and of our Muschelkalk. The *Tirolites* from the Werfen beds represent a far lower stage of development than those of India and Armenia, so that, were the age of the deposits in which they appear not sufficiently ascertained, they might be regarded as having belonged to a far remoter period. The types of the Asiatic Permian forms reach far upwards into the Trias, as proved by *Hungarites scaphitiformis*, Hau., a sporadic "colonist" in the Norian Hallstatt Limestones, nearly resembling *Ceratites tropitus*, Abich, in its outward form, as in the details of its lobe-line. MM. Grünewaldt and Karpinsky have described two species from the Artinsk Sandstones: *Goniatites Artiensis* and *Sageceras Sakmaræ*, whose lobes are still unknown, but whose form and sculpture strongly remind us of the typical forms of *Trachyceras* from the Norian and Carnian horizons.

Tirolites.—The typical forms are: *Tir. Idrianus*, Hauer, *Tir. Dalmatinus*, Hau., and *Tir. Muchianus*, Hau. The genus is characterized by a simple lobe-line, with entire margin, as that of *Nautilus*. The non-dentated, large, lateral lobe is followed by a broad and flat saddle, sinking gradually with a slightly undulated bend towards the suture. Another lateral lobe is but slightly marked. The projection of the preceding coincides with the large lateral saddle. In the group of *Tir. Cassianus*, these forms are associated with some others having an incipient denticulation of the lobes and distinct second lateral lobe. The convex portion is smooth, or somewhat flattened; the sides are smooth, or covered with straight radially disposed folds, frequently ending in strong hollow spines on the margin of the convex portion. *Tirolites* is chiefly developed in the Alpine "Werfen" strata. After a long interval of time, the genus re-appears, again isolatedly, in the genuine "St.-Cassian" strata (*Tirolites spurius*, Mstr. = *Clydonites Friesei*, Laube, non Mstr.), and another, as yet unnamed form, belonging to the series of *Ammonites Cassianus*.

Ceratites, de Haan (*Haaniceras*, Bayle (?), *Gymnotoceras*, Hyatt).—Besides *Ceratites Liccanus*, Hauer (very nearly allied to the Siberian species *Cerat. Middendorfi*, Keys.), another species, standing next to the group of *Tirolites Cassianus*, is met with in the "Werfen" strata. The same affinity appears in *Cerat. Smiriagini*, Auerbach, and in *Ceratites Bogdoanus*, Buch, both from the Bogdo Hills in the Steppe of Astrachan. In some of these transitional forms (*Cerat. Liccanus*, *Cerat. Smiriagini*) the second lateral saddle is wanting, so that the projection of the precedent whorls falls on the umbilical side of the large lateral saddle. A Siberian form, differing from *Cerat. Eichwaldi*, Keys., by its rounded and smooth convex

portion, may be considered as a connecting form between *Ceratites* and *Tirolites*. The genus *Ceratites*, as adopted here, nearly coincides with the group *Nodosi*, Beyrich. The convex portion is constantly without sculptures, smooth, convex or flattened (in one series of forms with an indistinct medial carina). The sides are covered with moderately curved ribs or folds, multiplied by bifurcations or intercalations, and frequently adorned by umbilical, medial, and marginal spines or teeth. The number of knotted spirals varies between 0 and 3. The anti-siphonal lobe is double-pointed. The *Ceratites* of the German Muschelkalk are strikingly discrepant from the Mediterranean types by the shallowness of their lobes, possibly in consequence of anomalous proportions of the salt held in solution by the old German Sea, in which the Muschelkalk was deposited.

In *Cerat. Khanikoffi*, Opp., an Indian species, the notch of the lobe-line extends over the tops of the saddles.

Balatonites, Mojs.—This genus comprises the series of forms of *Balat. Balatonicus*, Moys., *Balat. euryomphalus*, Ben., and *Balat. Pragensis*, together with the Central-European form *Balat. Ottonis*, Buch. Lobes like those of *Ceratites*; anti-siphonal lobe unknown. Convex portion with a range of knobs running over its centre, in some cases taking the form of a carina by confluence of the knobs. Ribs numerous, constantly with umbilical and marginal spines, frequently with one or more intermediate ranges of knobs. One form from the Muschelkalk has on each side seven ranges of knobs, besides the row on the convex portion.

Acrochordites, Hyatt.—Only one very rare Mediterranean form from the Upper Muschelkalk is connected with *Acroch. Hyatti*, Meek, the American type of this genus, characterized by ribs, passing over the convex portion, and alternately confluent by three and three into a large knob on the umbilical margin, and other ribs, simply terminating at the same marginal lobes as those of *Ceratites*. Certain Mediterranean forms with continuous sculptures over the whole convex portion, without any knobs, or with a number of small spirals of knobs, may be conveniently ranked among this genus, which seems to be very closely allied to *Balatonites*. Possibly *Ammonites spinescens*, Hauer, may find its place in it.

Hungarites, Moys.—Narrow, fold-like ribs, high median carina; lobes like those of *Ceratites*. Possibly *Ammonites scaphitiformis*, Hauer, so similar to *Cerat. tropitus*, a Permian form from the Araxes defile, may rank in this genus. If there be a real connexion between the Alpine Triassic forms and the Permian species from Armenia, it would be a proof of genetic difference between the preceding and the coeval European forms.

Arpadites, Moys.—A limited, well-characterized group, represented in the Mediterranean province by *Arp. Arpadis*, Mojs., *Arp. Szabai*, Boeckh, *Arp. Manzonii*, Ben., *Arp. Achelous*, Mstr., *Arp. brevi-costatus*, Klpst., *Arp. sulcifer*, Mstr., *Arp. Rueppeli*, Klpst., *Arp. Sesostris*, Laube, *Arp. Hirschi*, Laube, and several new forms;—in the Juvavian province by the groups of *Arp. Haernesii*, Hauer, and *Arp. Laubei*, Mojs. (*Arp. Rueppeli*, Hauer). The genus is characterized by a deep

furrow in the centre of the convex portion, and a long one-pointed antisiphonal lobe. This furrow is frequently limited by smooth or knobly carinæ. In some forms the ribs end in a thickening near the furrow. A number of dichotomous or simple ribs, all of them beginning at umbilical knobs, cover the sides, on which there are also rows of knobs. The forms of higher geological age have high saddles, with entire margins; in others of less age, from the "St.-Cassian" strata, the notch extends over the heads of the saddles.

In *Arp. modestus*, an aberrant form, standing next to *Arp. Laubei*, the ribs unite over the convex portion.

Trachyceras, Laube.—The sculpture extends without interruption as far as on the convex portion, in the centre of which it is always interrupted by a narrow interval, close to which the Mediterranean forms show constantly one or more ranges of spines. In the Juvavian forms, minute notches at the ends of the ribs (see *Trachyc. bi-crenatum*, Hauer) or notched carinæ are of more frequent occurrence. Spirals of spines, of variable number in the different series of forms, appear on the inflected, bifurcated, or intercalated ribs. These spirals are more numerous on the series of less remote geological age. In some cases, all spines, except those of the characteristic ranges on the convex portion, are wanting. The lobes in forms of more remote geological age are quite concordant with those of *Ceratites*; in those geologically less ancient, Professors Quenstedt and Laube have first noticed the digitiform notches extending over the saddles, and the denticulation of the lobes increasing in depth.

Heracites, Mojs.—A limited series of forms in the Norian strata of the Juvavian Province, with intermediate forms, connecting *Her. Poeschli*, Hauer, with *Her. robustus*, Hauer. Body-chamber very short, about half of a whorl. Strong, in some cases inflated, ribs on the sides. Convex portion flattened, traversed by two delicate, filiform, spiral lines, sometimes with nodules at the points where they run across the ribs. *Her. robustus* loses every trace of sculpture on the convex portion as it advances in age. Sculpture is likewise wanting in some forms of less remote geological age, as *Her. foliaceus*, Dtm. The lobes are characterized by a few irregular deep sections, hanging far downwards—here *Her. quadrangulus*, Hauer.

Sagenites, Mojs.—The known forms, belonging to this genus, are—*Sag. reticulatus*, Hauer, *Sag. Giebels*, Hauer, and *Sag. inermis*, Hauer. In the typical forms the sculpture passes without interruption over the vaulted convex portion, which sinks gradually into the lateral portion; in some aberrant forms there is an interruption in the centre of the convex portion (as in *Ceratites*) and the narrow, canaliform, unsculptured band is accompanied by nodular incassations. The numerous, delicate, pliciform, transversal ribs are crossed by a system of more or less undulated spiral lines, lying very close to each other. Umbilicus narrow. Occasionally the shell is ornamented here and there with broad obtuse knobs. Body-chamber half to three-quarters of the whorl in length. Type of the lobes aberrant

TABULAR CONSPECTUS OF THE VERTICAL DISTRIBUTION OF THE TRIASSIC AMMONITES.

	Zone of Ammonites Casstanius.			MEDITERRANEAN PROVINCE.				JUVAVIAN PROVINCE.					
	Z. of Ceratites bi-nodosus and Balatonites Balatonicus.	Z. of Ceratites trinodosus.	Z. of Trachyceras Curionit and Trachyceras Keizer.	Z. of Trachyc. Anabisi and Daonella Lomniti.	Z. of Trachyceras Am.	Zone of Trachyc. anovoides.	Z. of Choristoceras Hauer.	Zone of Pinacoceras Metternichti and Arcetites gigante-galeatus.	Z. of Pliacoceras Parma and Didymites globosa.	Z. of Cladiscites ruber.	Z. of Didymites tectus.	Z. of Tropites sub-bullatus.	Z. of Trachyceras conoides.
<i>Tirolites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Ceratites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Norites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Balatonites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Hungarites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Trachyceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Arpadites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Acrochordiceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Aegoceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Amalthus</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Plychites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Carnites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Pinacoceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Megaphyllites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Sageceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Monophyllites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Phylloceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Arcetes</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Sphingites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cladiscites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Foannites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Didymites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Lobites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Tropites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Entomoceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Distichites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Sagenites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Heracites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Clydonites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Choristoceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Helictites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Badiotites</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Cochloceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>Rhabdoceras</i>	—	—	—	—	—	—	—	—	—	—	—	—	—

from other *Ceratitidæ*. Broad high saddle-trunks, from which depart divided leaf-like branches. Similar branches rise from the bases of the lobes. Auxiliary lobes uncommonly small.

CLYDONITIDÆ.

Clydonites, Hauer.—Generic type: *Clyd. decoratus*, Hauer. Evolute whorls beset with thronged, irregularly granulated, small ribs, uniting over the convex portion. Lobe-line with entire margin, undulated.

The high external saddle followed by a lower lateral one. *Clyd. modicus*, Dtm., possibly belongs to this genus.

Choristoceras, Hauer.—Generic type: *Chor. Marshi*, Hauer, with two-pointed first lateral lobe. Next to it stand several forms with entire-margined, rounded, first lateral lobe. Evolute whorls, free in adult individuals of certain forms, with simple straight ribs, interrupted on the convex portion, except in old individuals of certain forms, whose convex portion becomes somewhat flattened or depressed. Knobs, disposed in spirals, on the depressed or unsculptured part of the convex portion. In the whole six lobes, the deeply descending one-pointed anti-siphonal lobe particularly remarkable. *Chor. Marshi*, Hauer, *Chor. Haueri*, Moys., *Chor. rectangularis*, Hauer, and *Chor. Buchi* (*Klipsteinianum*, Laube) rank among this genus.

Helictites, Mojs.—Whorls evolute, with strong straight ribs, running without interruption over the convex portion. Lobe-line simply undulated, with minute notches, scarcely perceptible by the unaided eye. Species: *Hel. geniculatus*, Hauer, *Hel. Henseli*, Opp., *Hel. nasturtium*, Dtm.

Radiotites.—The St.-Cassian forms — *Ammon. Eryx*, Mstr., and *Ammon. glaucus*, Mstr., characterized by a narrow or keel-like pointed convex portion, and by falciform ribs, are morphologically so discrepant from *Choristoceras* that they must constitute an independent genus. Lobes entire-margined, undulated; anti-siphonal lobe long, one-pointed.

Rhabdoceras, Hauer.

Cochloceras, Hauer.

REVIEWS.

- I. — UNITED STATES GEOLOGICAL EXPLORATION OF THE FORTIETH PARALLEL. By CLARENCE KING, U. S. Geologist. Illustrated by 28 Plates and 12 Analytical Geological Maps. (Washington, 1878.)

THIS fine work forms the first volume (although the last published) of the Report of the Geological Exploration of the Fortieth Parallel, under the direction of Clarence King, its subject being the "Systematic Geology" of that region. The Exploration has covered a belt of country about 100 miles wide from N. to S., and 800 miles long, extending from the eastern foot of the Rocky Mountains to the Sierra Nevada of California, or almost across the Cordilleras where they are the broadest. Assisted by an ardent and untiring corps (including A. Hague, S. F. Emmons, and others) Mr. King has endeavoured to work out the continuous geology of this almost unexplored gap connecting it, as far as possible, with the territory surveyed by Whitney on the one hand, and with Hayden's field on the other.

The purpose of this volume is to present a brief systematic account of the data collected, and the inductions deducible therefrom, so that the arrangement is chronological, beginning with the deposits of