[A translation of A. Kornhuber (30 July 1901), "Opetiosaurus Bucchichi. Eine neue fossile Eidechse aus der unteren Kreide von Lesina in Dalmatien." *Abhandlungen der kaiserlich-königlichen geologischen Reichsanstalt, Wien* 17(5): 1-24, with 3 plates. As is characteristic of the time, references to the literature are contained in footnotes, all of which are provided here as sequentially numbered endnotes; to allow the reader to compare these with the original, the page number and footnote number, in that order, are provided in square brackets subsequent to the number of the endnote. All footnotes in this translation are my own. In cases of uncertainty, the original German is quoted in square brackets; my own clarifications are in italics in square brackets.

Opetiosaurus Bucchichi

a new fossil lizard from the lower Chalk of Lesina in Dalmatia

By

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With one photographic and two lithographic plates.

Introduction.

In the extensive quarries so long operational between Verbosca and Vérbanj, east of Cittavecchia on the island Lesina in Dalmatia, nearly completely preserved remains of a new fossil saurian were again unearthed in 1899.

The acquisition of the petrifactions just named we owe to the unremittingly active Mr. Gregorio Bucchich[1], correspondent and friend of many years to the Royal Imperial Geological Institute, highly honored for his investigations on the natural history of said island by observation, collection and procurement ["Herbeischaffung"] of various objects from the recent and extinct animal and plant worlds.

They [*the petrifactions*] consist of portions of a part and of a counterpart which enclosed the remains of the animal and moved together as one in the layer of the mountain. From the size of the outline, the pieces of the part are of greater import than the pieces of the counterpart, of which only four small pieces were salvaged during the excavation of the fossil. The largest piece of the part has the form of an irregular square, nearly a trapezoid, 0.54 m in length and 0.44 m in height. It contains the head and most of the torso of the animal, that is, all presacral vertebrae with their ribs, the two sacral vertebrae, and a portion of the anterior caudal vertebrae (these mostly as impressions), as well as the forelimbs, the right hindlimb, and the conspicuously long end of the tail, which is partly an impression and partly comes to us as actual osseous vertebral tissue. The animal is resting on its back. Thus the ventral side of the vertebral column is visible, namely with the underside of the vertebral centra facing the observer. Only in the cervical section, which is strongly arched backwards and to the left, do parts of the lateral surfaces or of the front or back ends of the vertebrae become visible. As the animal was embedded in the marine calcareous mud, later hardened to stone, massive pressure of the [*overlying*] waters appears to have developed on the left side of the animal alone. As a result, the head, with the contiguous anterior-most three vertebrae of the neck, appears to have been violently separated from the others and shifted to the right side of the animal, up over the the tail, which is is laid out here in a rather straight stretch. It [*the tail*] lies on the stone about 0.22 m (measured in the anterior direction) from the 25 presacral vertebra. The ribs, lying on the left side of the vertebral column or also tightly appressed, speak further to the pressure mentioned above, whereas those of the right side stand with their distal ends free from the vertebral column. Then the right forelimb was taken from its natural position, and also the right shoulder, which was partly loosened from it, was pushed out to the right; the left forelimb was likewise displaced in this direction, so that it, with the remains of the left portion of the shoulder girdle, projects far over the midline of the vertebral column and is preserved crossing it. Three smallish pieces of the counterpart, whose broken edges partly correspond to the lower back end of the large part and partly fit one another, and which can be joined, contain an impression of the proximal end of the left femur, then its distal end, as well as the bony substance of the left lower leg and and foot, and further away, less clear impressions or even skeletal portions of the anterior third of the caudal vertebral column.

A large, triangular space where a piece of the rock was unfortunately lost separates the last-mentioned smallish piece of the counterpart from the lower edge of the large part. Therefore the respective piece of the caudal vertebral column is also missing and does not follow the hind part of the tail, which, as noted, lies on the largest piece of the counterpart between the head and body.

Of the the counterparts, three smaller pieces of show part of the anterior piece of the caudal vertebral column and a fourth, somewhat larger, the head, mostly preserving the substance of the bones, next to those bones of the caudal vertebral column that are preserved on the large part only as impressions. Thus the stony plates, which enclosed the bony framework on both sides, above and below, often complement one another in a desirable way and ensure the interpretation of the preserved skeletal remains.

The rock in which the the pieces were embedded has a conspicuous similarity of appearance with the lithographic shales of Solnhofen in the Frankish Jura of Bavaria[2], and the type of rock has also been given precisely this name[3]. There are namely low-density, light yellow-gray—here and there streaked with red—, thick, matte limestones that are layered into plates mostly from 1–3 cm thick. These plates are fairly flat, or only here and there wavy, and break flatly.

This plattenkalk was for a long time known as “fish-producing calcareous shales” because of the occurrence of fossil fishes. The first notice of this was given by Fortis[4]. Later there were very fine specimens in the posession of Prof. Carara in Spalato and in the Chief Imperial Mineral Cabinet in Vienna. J. Heckel[5] transmitted extensive descriptions of them and then added a few more to those with R. Kner[6]. At the encouragement of v. Hauer, Fr. Bassani, Prof. of Geology at the University of Naples, has finally treated the ichthyological fauna there in detail[7]; Prof. Kramberger (Agram) also presented “Paleoichthyological contributions”[8].

The first reptile to become known from the quarries is *Hydrosaurus lesinensis*, which I described.[9] Since then Prof. Dr. Karl Gorjanović-Kramberger, in the *Rad* of the Jugoslavian [“südslavischen”] Academy of Art and Science in Agram (v. 56, p. 96–123, Pl. I, II; translated into German in the journal of the “Societas historico-naturalis croatica”, v. 7, Agram 1892, p. 72–106), has described the well-preserved remains of a lacertilian and two other fragments, which are presently the property of the widow of Mr. J. Novak, instructor in Zara, and were discovered on the island Lesina in the quarry of the village Vrbanj by the farmer Ivan Račić. Kramberger erected for it a new genus, *Aigialosaurus* (*αιγιαλοσ*, coast, shore), named the large, well-preserved species *A. dalmaticus*, referred vertebral fragments to another species, *A. Novaki*, and finally compared a piece with two whole and two half dorsal vertebrae, several rib fragments, and impressions of the humerus, radius, ulna, and metacarpals to the similar *Mesoleptos Cendrini*[10] from the black shales of the lower Chalk of Komen in Görzi, which is reposited in the Museo civico of Milan. According to Woodward's *Guide in British Museum* [sic?]: *Reptiles*, there is there a “fine specimen” of *Aigialosaurus dalmaticus* from Lesina, the discovery of which was not made known to me. Prof. Dr. O. Jäkel, as Prof. V. Uhlig most kindly notified me, also claims to have collected a specimen of *Carsosaurus* in the calcareous shales of Lesina.

Concerning the geologic age of the *plattenkalk*, it is at this time not yet established with certainty. According to their stratigraphic relationships they belong to the lower Chalk, where Bassani[11] also placed them on the basis of his studies of the fish fauna, and so in the Aptian level of Gaul. He compared it [*the fauna*] with the fauna of Komen, which he held to be contemporaneous, or—on account of a few forms—only a little older. The conclusions of

Kramberger[12] are also in agreement: he also drew comparisons between the few reptiles that have thus far become known from the two localities. This view is furthermore not contravened by the results of Stache's researches.[13] According to these, a depression extends from Cittavecchia unto the haven of Verbosca; this trough is filled up with Terra rossa, fine sand and *Gesteinstrümmern* [*ruins of stones → graywacke?*]. South of this is a nearly east-west trending anticline, building the spine of the mountains, to whose north- and south-dipping layers our rock belongs and on whose north slopes the quarries lie from which, again, the new fossil stems. But the uncertainty noted in the determination of the age of these fossil-producing beds of Lesina is especially grounded in the circumstance that one was unable to discover sufficiently well-preserved petrefactions in the chalks that overlie them[14], although these chalks themselves occur under the rudist-producing beds of the upper Chalk which are broadly distributed and highly developed on the island.

The great difficulty that the character of the rock type that encloses our fossil causes for a detailed examination of some particulars I have already thoroughly emphasized at the time I published *Hydrosaurus lesinensis*[15]. This time I also made protracted and laborious attempts to prepare the skeleton as much as possible and to remove the calcite crust that covered many places and adhered with exquisite firmness. The first work by mechanical means with the best and keenest delicate chisels was only successful on the vertebral centra and on the proximal ends of the ribs. The method failed, however, on the larger limb bones, on the distal ends of the ribs, on the smaller elements of the caudal vertebral column and the like, because the bony parts to be prepared ran the danger of crumbling on account of their brittleness. I resorted once more to chemical agents. In this I enjoyed the expert advice and the kindly support of my friends, Mssrs. Hofr. Prof. Dr. A. Bauer and his assistent Friedrich Böck, as well as Prof. Max Bamberger. Mr. Böck was especially passionately interested in solving the problem and undertook several experiments after detailed discussions with myself. After the substances already mentioned in my previously mentioned work, namely concentrated acetic acid, hydrochloric acid and nitric acid in varying concentrations, had been applied to well-isolated bits of rock and, as before, just as little favorable results had been achieved, we experimented with more fluid carbonic acid, which we allowed by means of [“mittelst davon” + genetive] saturated wads of filter paper to react on limited places after first having surrounded them each with a small wall of beeswax. Lastly we applied, in the same way, a concentrated solution of *doppelt kohlensaurem Natrium* [*sodium bicarbonate?*], in which excess, undissolved salt remained. This last experiment proved to be the relatively most practical. Thus we succeeded, in the larger of the four counterparts, which best represents the head, in removing, on the more fixed parts of the skull from its entire posterior portion, the not inconsiderable crust of carbonate atop the quadrate and the suspensorium, then [*also*] from parts of the occipital segment and the neighboring parietal with the temporal fossae, partly also from the first three cervical vertebrae attached to the head, and so enabling a close examination of the elements indicated. In the application of this procedure to smaller, flatter skeletal parts that rise only a little or not at all above the level of the stone plate, the adverse circumstance arose, that the reaction of the acid could not be well circumscribed, so that not only the crust covering the bones but also the surrounding, closely adjacent little particles of rock were attacked and lifted off in the form of small flakes. It was feared that the solution of *zwiefach* [sic?] *kohlensauren Natriums* [*sodium bicarbonate?*] could continue somewhat under the bone and finally cause its separation or lifting from the stone plate, which convinced me to abandon further chemical treatment of the object and content myself with the favorable result that had been achieved especially on the fixed skull and attending pieces. It is my pleasant duty to extend again here my most obliging thanks to the aforementioned Mssrs. for their gracious support and for their genial labor. It cannot be doubted that the procedure with *doppelt kohlensaurem Natrium* [*sodium bicarbonate?*] will certainly prove itself to be much more successful with rock of a different character, as seen in the plattenkalk of Lesina. This is the case when the bedding plane or splitting surface of the rock type in which the petrefaction is embedded has a more consistent, coherent structure, without the fissility of the deeper layers, so that the rock is not inclined to disintegrate surficially into thin lamellae, a peculiarity of the black, bituminous shales of Komen, among others, where Jak. Heckel[16] with his fish petrefactions as well as myself with *Carsosaurus Marchesettii* were able to achieve better success with previously known chemical methods.

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I now proceed to the description of the new find; only after the conclusion of the description will comparative observations and their implications be added.

A. The Head.

The best-preserved remains of the skull, as already noted, are to be found on the counterpart of the pertinent part of the large main slab. This contains namely the osseous tissue of most of the bones of the head bestowed to us, whereas the part predominantly presents only the impressions worked in it by these very bones. By connecting both figures of the head—namely, the one in the photograph or in the *Lichtdruck* produced from it, where all pieces of the part are reproduced, and the one represented by a lithograph of the counterpart of the head in Pl. III, Fig. 1—, roughly like the combined sketch of the outline drawing of Pl. II strives to make sensible [“versinnlichen”], one is in the position to gain a better comprehension of the construction of the skull of our fossil.

Because the animal lies on its back, the head accordingly appears to be pressed onto the part with its upper side, that is with the skull roof [“Scheitelstirnfläche”]. With the head in this position the mandible projects its lower edge upward. After the disintegration of the soft parts, the loose connection of the suspensorium of the mandible as well as the symphysis at the anterior ends of both rami, which does not consist in a true joint, were loosened by the pressure of the mud and water masses overlying the remains of the animal. The original vertical orientation of the rami was therefore distorted by compression: indeed, the right ramus was laid flat on its inner side, the left in contrast on its outer side. One also sees them lying in this position in the stone of the small counterpart; they therefore turn their opposite lateral surfaces, namely the right mandibular ramus its outer side, the left its inner side, toward the large part [i.e., *not counterpart*] and accordingly leave behind impressions on it, or but pieces of the six individual bones that constitute them, as will be discussed more closely in the description of the lower jaw.

Our slabs provide clues to the more detailed depiction of the construction of the skull, particularly the occipital [“Hinterhauptsbein,” *which, for Kornhuber, includes the supraoccipital, exoccipital, and basioccipital: see below*], the parietal, the frontal, the pre- and postfrontal [=*postorbitofrontal*] and their processes, the jugal, squamosal [sic., *actually supratemporal*], supraorbital [*palpebral?*], and supratemporal [sic., *actually squamosal*], the quadrate and the lower jaw, less so the palatine, pterygoid, *Felsenbein* [*opisthotic + proötic?*] and ectopterygoid, the maxilla and premaxilla, and the nasal and vomer.* Of the remaining bones of the head, none is represented or even only suggested.

On the posterior-most right side of the skull roof, Pl. III, Fig. 1, next to the posterior end of the right jaw ramus, are remnants or fragments of the first three cervical vertebrae, unfortunately incompletely preserved. In front are the occipital and then parietal segments and in large part the frontal section as well, with the temporal fossa [“Schläfengruben”], then the orbits and their margins. Because of an oblique break during the excavation and extraction of the stone slabs that bear the fossil, however, the fore part of the head with the facial bones were lost. The fracture falls close to the connection of the nasal with the frontal and of the maxilla with the prefrontal and the lacrimal. Thus nearly a third of the head, *circa* 5 cm in length, is missing, except for the lower jaw. Only a poor mold of it on the part shows the roof of the oral cavity, specifically weak imprints of the paired vomer and the tooth rows of the maxilla

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* Kornhuber uses native German words for the bones here, and some usages, when translated, appear to be mistakes. He confuses the supratemporal and squamosal (see Pl. 2). By “supraorbital” he possibly means the palpebral. What he calls the “postfrontal” is a fusion of the postfrontal and postorbital.

and premaxilla, where especially the tooth shafts or sockets and a few remnants of the curved ["gekrümmten"], conical crowns are visible. Tiny traces of dentition can be seen encrusting most of the front third of the left mandibular ramus. The articular, at the back end of the right ramus, is well preserved in articulation with the quadrate and is followed (anteriorly) by an oblique break in the same bone and further still the impression of the remainder of the mandible with especially nicely formed negatives of seven of the hind teeth and a few less distinct ones of the front teeth. Exteriorly on the distal [*anterior*?] quarter of the mandible lies the imprint of a small longish, columnar bone, which comes from the broken-off columella[17], and next to it traces of the tooth crowns. Both can also be perceived on the part, where they are materially present. Also appearing more or less clearly on the part (Pl. I), and for the most part well-encrusted, are impressions of the occipital complex ["Occipitale"], the parietal, and the paired frontal. A weakly raised little ridge rises from the latter, corresponding to the median suture; likewise diverging raised lines run anteriorly which correspond to the lateral fissures that the frontal suffered as a result of pressure and that are especially conspicuous on the counterpart. Good impressions of the paired prefrontal and the orbital margin ["Orbitalumrandung"], less clear ones of the postfrontal, maxilla and premaxilla, which are for the most part strongly encrusted by calcite, are also present on this plate [*the counterpart*]. Naturally, all impressions correspond to the upper side of the skull. On the maxilla only a few tiny traces of tooth crowns can still be recognized. The lower jaw, however, left a surprisingly beautiful impression on the part, on the basis of which the jaw will be described further below. Only with regard to its position will it be noted here that only the anterior and posterior quarters of its left ramus are visible, for the middle appears covered by the skull, whereas the right ramus lies with the exquisite dentition free and leaves a half-disc-shaped impression of the quadrate to be discerned next to it, against the occipital segment of the skull.[18]

It is primarily the upper part of the occipital that is visible on our counterpart (Fig. 1, Pl. III), i.e., the supraoccipital (s. o.), an irregularly hexagonal small plate of bone with a shallow, median groove bounded by two weak ridges. It slopes rather steeply posteriorly and ends in a short, flat arch ["Bogen"], which probably represents the trace of the posterior skull opening, the foramen occipital [*magnum*]. As a result variously of pressure and crushing, which were not seldom accompanied by by breaks and displacements, the interpretation of individual elements is made difficult and sometimes also doubtful. Thus, the little indistinct pentagonal piece of bone that lies on the midline of the skull posterior to the just-described piece could be seen as the azygous basioccipital (b. o.), which participates significantly in the construction of the occipital condyle. To the side of this bone, as well as of the supraoccipital, lies then the paired exoccipital (exo.), whose posteromedially directed processes contribute to the completion of the just-mentioned occipital condyle. Laterally, violently separated from the proximal part of the exoccipital by a break into whose cleft, it appears, a part of the first cervical vertebra was pushed forward, lies the distal section of the exoccipital, which, as we will see further below, participates in the suspensorium via the quadrate. This process belongs to a separate bone in the very first developmental stages in lizards which very soon becomes fused with the exoccipital—the paroccipital of Owen, or the opisthotic of other English and German anatomists—of which it constitutes only a portion and therefore may not be taken to be the *pars pro toto*. It is probably most appropriate to term it the processus paroticus (p. parot.) of the exoccipital.[19]

The parietal (pa.) lies adjacent to the occipital anteriorly; it is an azygous rectangular bony plate that, broadening anteriorly, streches sideways with winglike processes to the postfrontal and borders the posterior edge of the frontal in a transverse suture, the fronto-parietal suture. Although it cannot be established with certainty on the slabs, this suture also appears, as in other lizards, not to be a true *Zackennaht* [*interdigitating suture?*]; rather, the furrow-like anterior edge of the parietal clasped the posterior margin of the frontal to enable a certain mobility of these bones.[20] In the anterior third, 5 mm distanced from this suture on the midline, which corresponds to the fontanelle of the separated halves of the parietal at an earlier ontogenetic stage, the foramen parietal is clearly recognizable, generally known as the unossified remnant of a larger embryonic parietal hole. In its posterior half the midline is somewhat deepened; the lateral margins of the parietal run in an inwardly convex arch and constitute the upper border of the temporal fossa, on which both the squamosal [sq.] and the posterior process of the postfrontal lie. The latter [sic.] articulates posteriorly with the supratemporal (s. t.), a thin, oblong bone. From the posterior corner of the parietal diverging processes run obliquely posteriorly and laterally, the parietal process (p. p.), which, however, are cut through in our object by an oblique fracture, which also partly extends onto the adjacent squamosal.† The distal end of each parietal process pushes between the parotic process of the lateral occipital, or the exoccipital, and the squamosal and serves to secure this bone in its connection with the distal end of the supratemporal. Combined, all three of these bones are in articular connection with the cephalic condyle of the quadrate. Next to the just-named bones lie smaller little pieces of bone that appear to represent parts of the proötic (petrosal) and the pterygoid. The strong posterior process of the postfrontal connects with the anterior end of the supratemporal. On our counterpart, Pl. III, Fig. 1, at the posterior upper margin of the quadrangular ["rechtseitig"] quadrate and also in impression as a mirror-image on the outline-drawing (Pl. II), the suspensory apparatus mentioned above, the suspensorium for the quadrate, is to be noted. Oblong fragments of bone, which can be discerned on the slab lateral to the parietal between the elements of the suspensorium, could derive from the posterior part of the pterygoid.

The frontal (fr.) is a very elongate sheet of bone, on which the mutual suture of the paired elements that earlier comprised it is now only clear at the posterior end that borders the parietal. Additionally, the surface of this bone shows several fine, anteriorly diverging fractures, splitting of the brittle bony plate that probably resulted from the high pressure. Its posterior edge is united with the anterior margin of the parietal at a nearly straight suture in the previously disclosed manner. From this place of articulation, the frontal narrows anteriorly, or becomes embayed laterally, which concavity constitutes the upper margin of the orbit. The anterior end of the lateral edge unites with the prefrontal, the posterior end with the postfrontal. Anteriorly it appears to have been adjoined by the now-missing, paired nasal; it may have been separated from the maxilla by the highly developed prefrontal (pr. f.). This paired prefrontal is a robust, triangular bone that narrows posteriorly and adjoins the supraorbital (su. orb.) laterally. With their posterior ends, between which the inconspicuous lacrimal inserts, scarcely recognizable on our slab, both [*prefrontal and supraorbital*] constitute the anterior margin of the orbit. The well-developed, arch-shaped, angular (ju.) continues this [*margin*] laterally and posteriorly, as our counterpart shows rather very clearly. On the left it is missing entirely, and its middle or angle, around 2.5-cm-long, lies on the large part, on which, however, only an impression is present of the right jugal. The paired postfrontal (po. f.), which adjoins laterally the two bones that are united at the frontoparietal suture [i.e.*, frontal and parietal...*], sends a process laterally and somewhat anteriorly for articulation with the posterior end of the jugal and thereby borders, as with the process that slopes anteriorly and medially and leans against the posterolateral corner of the frontal, the posterior margin of the orbit. On the floor of this [*the orbit*], as already mentioned, are encrusted, band-like swellings, which, according to their position, must be seen as the pterygoid, running from the posterior orbital margin, and as the ectopterygoid (tr.), [*running*] toward its lateral [*margin*], then as the palatine, directed toward the anteromedial orbital margin. A third process of the postfrontal runs straight posteriorly to unite with the supratemporal and participates indirectly in the construction of the previously described three-part suspensory arch ["Schwebebogen"], which functions to suspend the quadrate and thereby the lower jaw.

Unfortunately, on account of the transverse breaking-off of the anterior part of the skull mentioned above, only very tiny fragments of the maxilla remain. To this belong, right and left, anterior and lateral to the prefrontal, supraorbital and the anterior end of the jugal, the respective fragments ["Bruchstücken"] of this most significant of the facial bones. Mention was already made of the alveolar margin of the maxilla and that of the premaxilla, as well as of the traces of the vomer, in the treatment of the impression on the counterpart, which derive from the lost pieces of the anterior part of the head. The maxilla, as can be concluded from the

† He really only means that the *left* parietal (=supratemporal) process is broken, not both. As noted before, "squamosal" here is really the supratemporal bone. His "supratemporal," again, is really the squamosal.

preserved fragments, borders on the prefrontal, a characteristic of the Varanidae, and not on the frontal, as is the case in other saurians, Lacertidae etc.

The right quadrate, os quadratum (q.), *l'os tympanic* of Cuvier, is well preserved on the small counterpart of the head of our fossil, and its lateral side was entirely freed by chemical preparation; it constitutes a robust, rather thick bone of conch-like form with a laterally directed ["gekehrter"] concavity. Its upper, convex margin—somewhat thinner anteriorly, thicker posteriorly—extends as a hook-like curve posteriorly. The posterodorsal margin also bears the proximal cephalic condyle of the quadrate, which connects with the three coalescent articular surfaces found at the distal ends of the supratemporal, squamosal and processes paroticus. This joint serves primarily for the rotation of the quadrate around its horizontal axis during opening of the mouth—lowering of the jaw—but doubtlessly also afforded a certain rotation of the quadrate around its vertical axis and tehreby a slight lateral displacement of the lower jaw. The distal end of the quadrate is somewhat reduced in size and, with its mandibular condyle, provided for articulation with the articular of the lower jaw, on whose medial side, apposing the corresponding condyle, is developed the articular face ["an dessen Innenseite die dem gennanten Condylus entsprechende Facies articularis angebracht ist"]. On our slab on the posterior fifth of the right ramus of the lower jaw, whose osseous tissue was preserved, one sees this joint indicated by a conspicuous emargination of its dorsal margin *vis-à-vis* the distal end of the quadrate.

The outline ["Grundrisse"] of the lower jaw, or mandible (md.), corresponding to the wedge-shaped skull, has the form of an isosceles triangle at whose apex a symphysis unites the two halves of the jaw. This symphysis, in the living animal, consisted of fibrous connective tissue, for all signs of a well-developed bony suture are lacking.[21] Each half of the lower jaw, also called a ramus, is composed, as in other Sauria, of six pieces of bone, connected to one another by sutures, *viz.*, the tooth-bearing piece, or dentary (d.), the covering piece, or opercular (op.) (splenial of Owen), the angular (an.), the sur- or supraangular (su. an.), the articular (ar.) and the crown-piece, or coronoid (co.). On our stony slab the lower jaw, with its two rami, presents itself in the following manner:

On the counterpart that contains the skull, Pl. III, Fig. 1, the symphysis, which in consequence of the progressive decay saw its fibrous matter gradually soften and loosen, is shown to be separated. At the same time the halves of the jaw were turned onto their sides by the pressure of the water, and thereby their anterior ends were somewhat displaced, so that the left end came to lie somewhat atop that of the right half. Their lateral surfaces were pressed against the enclosing and later hardening mass of rock, so delicately ["zart"] that now, on the counterpart, the lateral surface of the right ramus appears in correspondence to the natural position of the animal in those places where its bony matter was preserved, whereas in places where the bone is missing, deepened impressions of the medial surface of the ramus are seen. Thus there appears on the counterpart the proximal end of the right jaw ramus with the articular, and namely, its lateral surface, and one recognizes also the place where this piece of bone articulated with the distal end of the quadrate, as mentioned above. The bone is then transversely broken off, and anteriorly the impressions of the medial surface of the supraangular, and below this also those of the missing part of the articular and the angular and over both the triangular impression of the coronoid, as well as the angled suture at which the above-named pieces of bone join with the two elements that compose the anterior part of the jaw ramus, namely the opercular and the dentary, are seen more or less clearly. Posteriorly on the dentary, six rather distinct impressions of the tooth row ["Zahnreihe"] are present; anteriorly there are equally numerous but less distinct impressions. When one compares the area of contact of the just-described surface on the part, then one sees there the impressions of the lateral surface of the articular, which extends far anteriorly, then above it the supraangular and under it the angular, farther along the aforementioned suture that runs in an angled groove, farther still and above the medial surface of the coronoid, the bone of which is present, whereupon the opercular, whose matter is only partly preserved, and the dentary, crowned by the beautiful, well-preserved tooth row, seen medially, follow anteriorly.

Only the anterior third of the left mandibular ramus is preserved on the counterpart—on the part one also sees, in part, the posterior third—whereas the middle is covered by the skull, and in particular is shut in by the mass of stone lying on its [*the skull's*] side, and so is not observable. This anterior third one sees medially on the counterpart, the bony matter present, with a few poor traces of attachment sites for the teeth, pseudoalvoeli, whereas its lateral surface adheres to the rock. Its [*the lateral surface's*] impression on the part, however, which is somewhat encrusted below, permits recognition dorsally of several not especially distinct tooth bases and depressions from the cone-shaped tooth crowns, whose tips appear posteriorly curved. The hard parts that left behind these impressions, however, were lost and can no longer be found on the counterpart.

The length of one mandibular ramus comes to 15 cm, the distance between the knobs at the posterior end of each ramus 7.5 cm.

Extraordinarily noteworthy is the dentition of our fossil. The teeth all have the same form—only slightly wider in the middle of the jaw—on average 4 mm, measured from front to back. A tooth count can be made with fair certainty on the right mandibular ramus on the large part and comes to 17. They either stand closely appressed to one another or show uneven interdental spaces, up to more than 1.5 mm. Because, as is known, the number of teeth in one and the same species of lizard often differs, being lower in youth than in the adult and increasing with progressing age, this point also has little significance in our animal. Most striking, however, is the form of the teeth, which does not otherwise occur in any lacertilian known thus far, nor in any saurian from the post-Cretaceous time. Each tooth crown is namely borne by a base, i.e., a bony little column or a support, 5 mm in height, on average, on which it sits, sharply demarcated and surrounded by a delicate, wall-like ridge ["Erhöhung"]. The base is cylindrical and, diminishing apically, terminates blunt and bevelled ["conisch"] at the circular place of apposition of the little crown. The side of the base is weakly striated and in the middle provided with a conspicuous, channel-like longitudinal depression that takes up nearly the fourth part of the width of the base. The tooth crowns are on average 2 mm in diameter at their base and over 3 mm in height; they are somewhat posteriorly curved with their conical tip and encased by a shiny, brownish enamel on which is seen no *Zähnelung* but rather only weak striae. In the left jaw on this slab, only six robust tooth crowns are clearly preserved; their bases cannot be discerned well, and the crowns are not directed in the same way, but rather are somewhat out of sight ["verdrückt"] and in part more posteriorly inclined than in the other ramus. Individual little crowns were also separated from their base and dispersed, as one sees such a crown lying, for instance, in the region of the columella. A kind of differentiation of the teeth, such as would cause ["veranlasste"] a division in some Sauria into incisors, canines and molars, is not found here. The described bases grow from the wall of the jaw ["sind dem Kieferrande aufgewachsen"] and appear to be somewhat sunken into the subdental lamella. The dentition can therefore, according to Wagler's distinction, be termed acrodont. Teeth of this kind are also present among Sauria in each giant, elongated, snakelike sea-lizards, the Pythonomorpha, whose remains were first found in the chalk tuff ["Kreidetuff"] of Mastricht [sic]—*Mosasaurus Hoffmanni* (1780) *Cuv.*[22]—and later in the chalk of North America—*Liodon, Clidastes* et al.[23] Similar teeth, of course, were even described in the most remarkable birds with toothed jaws from the Chalk formation of Kansas.[24]

The teeth of our fossil, in form in complete agreement and in exterior characteristics exactly the same as those of the large Pythonomorpha, in which a study could more easily be conducted, entitles one to assume that, between them, agreement in the most important features would also obtain in the histological construction of the teeth ["dass auch im histologischen Aufbau der Zähne zwischen ihnen eine Uebereinstimmung der wichtigeren Eigenthümlichkeiten obwalte"]. We can therefore accept without compunction the results of the study of the formidable teeth of *Mosasaurus* by Cuvier[25], as well as those achieved by Leidy[26] and Cope[27] on American species. According to Cuvier's interpretation the bases of such teeth are only hollow, so long as they grow. They become filled, then, gradually and length-wise, until at last they are for the most part completely solid. They adhere to the jaw by connective tissue matter, which ossifies by degrees and merges profoundly with them [*the teeth*] ["mit ihrer eigenen innig verschmilzt"]. According to Leidy's observations the dentin does not continue as a root from the enamel-covered crown, but rather ends at a place in line with the alveolar margin and does not enter into the crypt of the tooth, the tooth-cavity or the so-called alveolus. The base is thus no root covered with cement, as Owen[28] says, but rather is composed of a variety of bony matter that is close to cement.[29]

In the premaxilla and maxilla, unfortunately, only tiny traces of the dentition are present. On the small counterpart of the skull, where the nasal part of the skull is broken away, there is only their impression, that is, from the roof of the mouth or the hard palate, and even this is hardly clear on account of the calcite veneer ["Calcitüberrindung"]. Yet one can recognize approximately the location of the bases of the teeth by the gleaming markings ["der strahligen Zeichnung"], but little of the hook-like ["hakig"] tips or the crowns, which so clearly cap the the bases of the mandibular rami on the part. On this large part, there remains little to see of the tooth tips or the bases on the margin of the impression that derives from the upper jaw. From the features of the dentition in other Sauria, where its form in the two jaws is generally in agreement, one can conclude that hook-teeth sitting on bases were doubtlessly present in the maxilla and premaxilla of our animal as well. Of their number one can probably only express the hunch that they could have differed only scarcely or a little from those of the mandible.

B. The trunk.

The vertebral column, columna vertebralis, comprises 28 presacral and two sacral vertebrae, probably followed by 100 postsacrals, so that the number of all vertebrae came to about 130.

Of the presacral vertebrae, eight belong to the cervical series of the vertebral column. This decision is based on the presence of hypapophyses, as in many other Sauria (*apophyse épineuse inférieure* of Cuvier). The following 20 vertebrae can either all be termed dorsal vertebrae, or the last four, do_{17} through do_{20}, can be termed lumbodorsal vertebrae in the sense of Bergmann[30] because of their conspicuously shorter ribs. Lumbar vertebrae, which can be recognized as such by the absence of ribs, are not present in our fossil. The postsacral or caudal vertebrae are unfortunately partly in a bad preservational state, namely in the anterior section that immediately follows the sacrum; even a count of these with the relevant piece of the part has become completely impossible.

Cervical vertebrae.

The first three neck or cervical vertebrae (ce.) have remained attached to the occiput of the skull in the previously mentioned violent separation of the skull from the trunk. Unfortunately, and notwithstanding the careful chemical treatment of the counterpart (Pl. III, Fig. 1), I was unsuccesful in rendering completely clearly what derives from the atlas in particular. Below the pieces of bone that are attached to the occiput, whose several pieces were indicated in the description of the head according to their outlines, one sees, behind the suspensorial apparatus of the quadrate, and namely adjacent to the parotic process, a raised swelling of bone that continues further to the right under the suspensorium and may well be seen as the massa lateralis of the atlas. The second cervical vertebra, like the third, of which only a part is seen to the right on the slab, follow immediately posteriorly. They display their upper surface, namely as one rather broad arch each, to which the zygapophyses are joined laterally and on which a median, crest-like ridge rises. The latter corresponds to the neural spine.

Of the anterior presacral vertebrae, which are preserved on the large part, the first five, namely the 25th until finally the 21st, represent cervical vertebrae, namely the 4th through 8th, in virtue of the hypapophyses that are developed on them and are lacking in dorsal vertebrae. These hypapophyses arise on the underside of the vertebral centrum in the form of a median boss ["Erhabenheit"] that begins narrow, then gradually becomes broader posteriorly, and finally terminates in the usual position beneath the vertebral condyle in an ellipsoidal or nearly ball-like process, whose cap ["Kuppe"], however, appears largely shattered by the pressure of the rock mass. Because the undersurfaces of the vertebral centra are directed dorsally on the main stone slab as a result of the inverted position of our animal, the peculiarity just mentioned can clearly be discerned. The presence of these apophyses does not constitute a diagnostic character of any saurian group, as should ["soll"] be discussed more extensively later, for they are also better developed and in a more peculiar form in other [*groups*], e.g., in the Pythonomorpha. They also appear in many extant lizards[31]; Cuvier[32] establishes their presence in *Monitor niloticus* and Calori[33] in *Monitor terrestris Aegypti* (= *Varanus arenarius Dum. et Bibr.*) and in *Lacerta viridis* and *L. ocellata*, where their form is clearly reminiscent of the hypapophyses of our fossil from Lesina.

Otherwise the cervical vertebrae are already robustly developed; in size and form they differ only slightly from the dorsal vertebrae. They are anteriorly broad (18 mm), pass laterally into transverse processes, and narrow posteriorly (12 mm). On their under-surfaces lateral to the hypapophyses described above, their bodies or centra show isolated ridges of bone, predominantly aligned with the longitudinal axis, which were for the attachment of powerful muscles. A deep, concave, semilunate bulge on the anterior margin corresponds to the cotyle on the anterior end of the centrum. It was for the reception of the expanded ["erhabenen"] condyle on the posterior end of the next-most anterior vertebra, with which it articulated. As far as it can be determined from the fairly encursted vertebrae, specifically on the fourth cervical vertebra, the cotyle appears to have had a somewhat transversely expanded form, that is, a more ellispoidal one. The articular processes ["Gelenkfortsätze"] of Joh. Müller, or zygapophyses of Owen, arise laterally on each vertebra as oval expansions and are here, in the cervical series as in other sections of the vertebral column, so arranged that the articular surfaces of the postzygapophyses are directed downward and those of the prezygapophyses upward, so that the articular surface of each postzygapophysis lies atop that of the prezygapophysis of the next-most posterior vertebra and covers it in order to articulate with it. The articular surfaces are somewhat inclined, although differently in the various sections of the vertebral column, hence the name *processus obliqui* of Soemmering. In the cervical section the anterior surfaces are turned somewhat medially, the posterior ones correspondingly laterally. On our slab, as mentioned, the transverse processes, or processus transversi—diapophyses of Owen—appear laterally on the anterior end of the vertebrae as longitudinally oval, fairly well developed bulges that jut out somewhat obliquely, that is, as ventrally directed bony bulges if the animal is considered in its normal position.

Somewhat less well-developed on the fourth and fifth cervical vertebrae, they increase, on the following ones, *in eben dem Masse* more conspicuously in size than the ribs that attach to them, which is naturally the case as well in the dorsal vertebrae. For the attachment of the ribs, the distal end of each diapophysis possesses a simple, weakly expanded, ellipsoidal little capitulum for articulation with a complementarily weakly impressed articular surface on the somewhat thickened proximal end of the corresponding rib. This feature is also repeated on the dorsal vertebrae.

The neurapophyses and neural spines, that is, the upper vertebral arches and their spines, the processus spinosi, are not visible on account of the aforementioned inverted position of our animal.

As a result of the enormous pressure exerted by the surrounding masses that was once borne by the neck of the lizard, and the resultant tear between the third and fourth cervical vertebrae in the vertebral column, the other vertebrae were also dislocated at their joints, each one more or less shifted from its normal position; the entire cervical section of the column was strongly bent on itself and twisted to the left as far as back as the third sternal rib ["Brustrippe"]. Possibly a spasmodic contraction of the abundant neck musculature during the death throes at the violent end of the animal also contributed to effecting this so significant and conspicuous bending of the neck.

Dorsal vertebrae.

These forces appear also to have acted upon the dorsal segment of the vertebral column. Here as well, an abnormal, if also slight, bending of the same [*the column*] toward the right side of the animal may be assumed, for in the natural position it would extend more horizontally.

The number of dorsal vertebrae, as the rib-bearing but hypapophysis-free vertebrae can be seen, come to twenty. Lumbar vertebrae are lacking, and there follow immediately after the dorsal vertebrae two sacral vertebrae, a characteristic that appears in the Varanidae among others.

The dorsal vertebrae (do.) generally have the form of the cervical vertebbrae, as a mere glance at our slab suffices to show. Their size relationships show only slight differences. The length of their bodies, or centra of Owen, vary only a little from the measurement of 2 cm ["von dem Masse zu 2 cm"]. Longest are those in the middle of the dorsal section of the vertebral column: they grow somewhat shorter toward the sacrum and likewise toward the last cervical vertebra in gradual transition. The total length of the dorsal series comes to 38 cm.

The dorsal section of the vertebral column also shared in the injuries that our animal had suffered before and just after the time of its deposition and embedding from the pressure of the waters and of the mud supported within them ["des darin erhaltenen Schlammes"]. Furthermore, the actions in the quarry during the excavation of the petrefaction also contributed their own [*injuries*]. The left forelimb and the remains of the shoulder that attach to it proximally were displaced to the right from their natural position, and the right limb was likewise displaced laterally. The former thereby came to lie transversely on the vertebral column, whose respective part was covered, so that the vertebrae found there become ["werden"] hidden. As one is able to conclude from the dimensions of the preceeding and succeeding vertebrae, there are three vertebrae in this place, of which the anterior one, that is, the fourth dorsal vertebra, is only exposed anteriorly, the middle (or fifth) one not at all, and the following sixth dorsal vertebra only posteriorly. The other dorsal vertebrae are as a whole more or less well preserved and with their undersurfaces in view at the level of the stone slab.

The centrum of these vertebrae is thick and robust and has a relatively flat ventral surface (from anterior to posterior) with a median, channel-like depression that is somewhat shallower toward the ends of the vertebrae and whose raised margins, like the ridges mentioned on the cervical vertebrae, may have served for the attachment of muscles or fibrous ligaments. From right to left the surface is convex, and laterally softly rounded. The transverse processes are strong and longitudinally round and constitute uninterrupted ["continuierlich"] lateral, anterolaterally directed extensions of the vertebra, whose under-surface expands onto them. The zygapophyses are rather wide and similar in form to those of the cervical vertebrae. The attitude of their articular surfaces, however, appears to be less inclined. Their morphology is difficult to discern on our fossil and is best apprehended on the vertebrae of the posterior half of the dorsal section of the vertebral column, from about the 14th vertebra to the 20th. In this region the columna vertebralis shows a weak rotation about its axis toward the left side. Where no calcite crust adheres to the vertebra, nor any damage to the bony part has taken place during the excavation of the skeleton, ones sees to the right of the posterior end of the vertebra, anterior to the transverse process of the succeeding vertebra, roundish protuberances that correspond to the articulated pre- and postzygapophyses of the two abutting vertebrae.

Neurapophyses and neural spines—covered by the vertebral centra, as in the cervical vertebrae—are not visible.

Ribs.

To the transverse processes, as mentioned in the cervical series, are attached the ribs, or costae, or pleurophyses of Owen, which were maintined by connective tissue in a simple joint. Their proximal (upper), simple, undivided capitular end comprises the ellipsoidally depressed, nearly vertical articular concavity ["Gelenkpfanne"] for the reception of the correspondingly convex articular bulge on the transverse process. Ribs are already present on the cervical vertebrae, with the exception of the first three, but on our slab are unfortunately for the most part indiscernible because of the carbonate encrustation. Thus one sees on the right side of the fifth and sixth cervical vertebrae an adjacent piece of a rib, and the same on the seventh [*vertebra*] of the same side. Especially well preserved, however, is the right rib of the eights cervical vertebra. It is around 7 cm long, and 5 mm wide at the proximal end, and extends down along the ribs of the first and second dorsal vertebrae, where its distal end pushes in between them. The eighth left cervical rib, which reaches over to the left humerus, and also the seventh left cervical rib are recognizable, if somewhat encrusted. These latter ones already liken the dorsal ribs in form and approach these in length. In contrast, the first three pairs, so far as their encrusted condition permits conclusions, are short and flat, but robust, especially at their proximal ends. Posteriorly, however, they gradually increase in size.

The dorsal ribs, all twenty of which are clearly visible on the right side and in their relationship to the corresponding vertebra, also constitute thin but strong, latterally moderately curved struts of bone [“Knochenspangen”] whose proximal end, as in the cervical ribs, articulated in the indicated manner with the transverse process of the corresponding vertebra. Their lateral surface is convex and provided with small embossments for muscle attachment, the inner one rather smooth and depressed along its length like a channel; the upper edge is rounded off, [*whereas*] the lower one [*is*] narrower, somewhat angular toward the proximal end, more rounded again distally. Their length reaches a maximum from the 9th to 15th, where they come to about 10 cm; the 6th, 7th and 8th are each 9.5 cm long; posteriorly, namely from the 16th on, the 18th reaches 3.0 cm in length, the 19th 2.5 cm, and the 20th only 2 cm. Their width comes to a maximum of 5 mm at the proximal end and 2 mm at the distal end; it decreases posteriorly to 2 mm proximally and 1.5 mm distally. One can term the last four rib pairs dorsolumbar ribs like the vertebrae to which they are attached. On the left side the ribs are all more or less strongly pressed against the vertebral centra, whereby the evidence of their belongingness to the corresponding vertebra is sometimes made difficult. The last four ribs of the lefft side have been lost entirely. In that place, namely, the fracture of the stone slab runs close to the vertebral centra and coincides posterior to the second sacral vertebra with a transverse break that destroyed the caudal vertebrae.

The relationship of the dorsal ribs to the sternum, and so the construction of the rib cage and the differentiation into true ribs, which are connected to the sternum, and false ribs, whose distal ends, probably cartilaginous in life, no longer reach the sternum, can no longer be ascertained on our fossil. If one may be permitted to draw a conclusion about from the agreement in the number of cervical ribs and dorsal ribs, which occurs in most cases in the Lacertilia, then one could also suppose that there were five true ribs in our animal, an assumption, however, that can not be established with certainty.

On account of the aforementioned destruction of the shoulder girdle, there are also only very tiny and doubtful traces of the sternum present. Thus one sees, in the region of the right humerus, between it and the distal end of the first two dorsal ribs, a rhomboidal little plate of bone, which continues to the side, in particular to the left, as a thin little rod. It is possibly interpretable as remains of the episternum**, which forms the so-called T-shaped, anterior-most part of the sternum with said rod-like appendage. This appendage is closely appressed against a thin, longish, rather straight bone that is expandedat the ends and could be interpreted as the clavicle. Because the photograph of this detail was unable to represent this clearly, only mention of it will be made here in the text and its position on the original slab noted. For this reason as well there is on the outline-plate (II) neither a more definite circumscription nor a label. That a developed sternum was present is demonstrated by the multiple in-between pieces, or costae intermediae (co. i.), Pl. II, preserved between the dorsal ribs, in particular their vertebral pieces, on the slab, and the rather long sternal pieces, costae sternales (co. st.), Pl. II, which run out from them, angling anteriorly and toward the middle of the body, which certainly were for attaching to the lateral margin of a cartilaginous breast-bone. Such sternal pieces are found, among other places, on the left side of the vertebral column at the tenth dorsal vertebra, where lies in the proximity of the transverse process of the latter and extends anteriorly therefrom along the vertebral column until the middle of the body of the sixth dorsal vertebra. Such sternal rib pieces likewise lie on the right side of the body, e.g., near the transverse processes of the twelfth and eleventh dorsal vertebrae, where one sees them directed anteriorly, crossing the vertebral pieces of the ribs of these and many other vertebrae [“mit den Vertebralstücken der Rippen dieser und mehrerer anderer Dorsalwirbel sich kreuzend”]. Presumably, the position of the mesosternum on our slab, after the compression of the thorax and the displacement of the forelimbs, was finally to be found lateral

** Presumably he refers to the interclavicle.

to the right humerus, because one sees there a number of the aforementioned costae sternales, unfortunately irregularly arrayed, ending like an insertion [“nach Art einer Insertion enden”].

Sacral vertebrae.

The sacrum is composed of two vertebrae in our animal. They are similar to the dorsal vertebrae in form, except that their centra are somewhat shorter, specifically 1.6 cm long each, and their diapophyses more broadly apposed. Their preservational state is not as good, for they were affected by the fracture that also involved the anterior part of the caudal vertebral column immediately behind the sacrum. In an undisturbed position of the animal, the pelvic bones would have to have made an appearance and overlain the two sacral vertebrae. But the same are in greater part missing, so that the under-surface of the sacrum, turned upward at the level of the stone slab, are free. The calcitic encrustation, however, partly renders the upper [*observed?*] surface of the vertebrae unrecognizable.

On the centrum of the first sacral vertebra (sa_1), see Pl. II, as on the dorsal vertebrae, the longitudinal groove can clearly be seen which, together with the vertebral centrum, appears slightly laterally shifted to the left. On the second sacral vertebra (sa_2) this channel-like depression is scarcely recognizable any more, and the encrustation on it is greater. Yet one still clearly sees the connection of this second sacral vertebra with the first, a connection that must have been a much tighter, firm one, for the condyle is must less well developed than that of the antecedent ultimate dorsal vertebra, so there can only have been reduced intervertebral movement of the sacrum.

On the left side of the sacral vertebrae there runs the strong fracture of the main or larger part, whereby both the character of these lateral surfaces and that of the robust transverse process of the left side appear to be rendered unrecognizable.

At the posterior end of the second sacral vertebra one sees the angular, edgy location of the aforementioned fracture, which the vertebral column has suffered here. In this regard, a small part of the vertebral centrum was displaced, so that nothing more can be ascertained of the convexity of the condyle.

Caudal vertebrae.

At this point begins the long series of caudal vertebrae, which are distinguished by very well-developed transverse processes (p. tr.) as well as by strongly developed neuro- and haemapophyses (n. and h.) with thier processes, the neural and haemal spines (nsp. and hsp.). Unforunately it is precisely the beginning of this segment of the vertebral column, among all parts of the animal, that was most affected by destructive influences. The vertebral column is truncated just behind the second sacral vertebra, and only incomplete impressions and bony fragments, which moreover are covered in many cases by a calcite crust, permit one to assume, by means of comparison of the part and its counterparts and taking into consideration the dimensions determined for the succeeding remaining vertebral centra—each vertebra on average probably 14 mm in length—the presence of seven vertebrae (Pl. II, ca_1 to ca_7), counting up to the downwardly directed corner of the triangle that indicates the wholly missing slab.

In the breaking off of the caudal vertebral column, which occurred immediately at its beginning behind the sacrum, the total length of this section of the columna vertebralis was rotated toward the right side of the animal around its own axis, and thus the column [i.e., *the set of articulated centra?*] itself was somewhat displaced to the left. Thus, the haemal spines should have appeared upwardly directed, as they clearly do on the dorsal vertebrae and on the sacrum because of the inverted position of the animal, to make a rightwardly turning quarter-circle and were embedded in such a position on the entire caudal section at the level of the bedding plane. Accordingly, the neural spines of all caudal vertebrae are contrariwise sunk into this very plane on the side correposonding to the left half of the fossil. In addition to the parts, which are apparent on Pl. I and II by the fractures that developed during the excavation of the stone, three more fragments of the stony slab, Fig. 2, 3 and 4 on Pl. III, comprised the counterpart, just as we already mentioned in the discussion of the head, Fig. 1, Pl. III. They contain sections of the caudal vertebral column, indeed with nearly all the bone pieces that fit as positives to the negatives of the molds or impressions on the part. The state of preservation of two of these, Pl. III, Fig. 3 and 4, makes the determination of the correspondence between their features and those of said fragments of the part doubtlessly possible, which will ["soll"] be dealt with below. The third, Pl. III, Fig. 2, is somewhat more difficult to interpret. It contains three vertebral centra with parts of their neural and haemal spines, as well as their transverse processes, which apparently belong to the anterior-most part of the caudal vertebral column. One could hardly err in seeing them as remains of the third, fourth and fifth caudal vertebrae. The impressions of the remaining vertebral centra and their processes on the fragments of the part belong then to the first, second, and sixth caudal vertebrae. The length of this piece of the vertebral column comes to over 9.5 cm[34] on the part, or on average 14 mm for each vertebra, which stands in agreement with the length of the remaining anterior vertebrae figured on Pl. III, Fig. 2, as well as with the length of 16 mm taken for the sacral vertebrae, in comparison with which they [*the sacrals*] gradually diminish in size.

Now, as mentioned earlier, a triangular piece of the part is missing on whose lower, *vor-oder einspringendem* corner, i.e., the one toward the junction of three of the remaining pieces of plate, a vertebra was preserved and has been lost together with neighboring parts of the preceeding and succeeding vertebrae.

On the two following pieces—the negatives on the part, the positives on two like overyling counterparts, Pl. III, Fig. 3 and 4—, which belong together and are separated by a break in the stone slab, there lie twelve caudal vertebrae, and furthermore a fragment of another, ca_8, anterior (in reference to the animal) one, of which only something of the centrum and of the neural spine was preserved, and then also another, ca_{21}, at the end of this section, of which only half is preserved. On the two counterparts, Fig. 3 and 4, the character of these vertebrae is clearly discernible. Robust neural spines (nsp.), in which the strong, basically ["am Grunde"] 7-mm-wide neurapophyses (n.) terminate and combined reach a height of over 1.5 cm; well-developed, flat, horizontal, gradually tapering transverse processes (p. tr.), here and there broken-off, up to 1 cm in length and around 5 mm in width, and furthermore two side-pieces each of a haemapophysis (h.), which, converging on one another distally, finally are united as one haemal spine (hsp.) each.

On the vertebral centra one sees very clearly, especially on some of them, that, as in other Lacertidae ["Lacertiden"], each haemapophysis articulates with the posterior end of the vertebra itself to which it pertains and not at the place at which any two vertebrae are joined, which latter view is represented by R. Owen[35] and C. Gegenbaur.[36]

The second of the two said positive counterparts of this section of the vertebral column, Fig. 4, is the immediate extension of the one just mentioned, Fig. 3, of identical character and only separated from it by the fracture in the stone. By a small displacement, which clearly occurred after the decomposition of the soft parts (joint capsules and ligaments) that surrounded their articular ends, there arose in said sections of the vertebral column weak kinks that interrupted the continuity of its curvature, whereby the latter does not continue in a completely smooth curve toward the posterior bit of the tail but rather forms a blunt if significant angle. Now we arrive at the place where a piece of the stony slab was entirely lost, the triangular *Zwickel* terminating ventrally at its point, which we have already encountered in the descrioption of the eighth caudal vertebra. The distance between the two vertebral pieces that bound the lost portion of the caudal vertebral column anteriorly and posteriorly comes to 12 cm, a length measured along the curve of the bending of the tail. In this stretch there were presumably 11 vertebral places, at which count one arrives when one envisages the dimensional length of the vertebrae preceeding the missing piece (11.2 mm) and of those following it (9 mm) and thereby also considers somewhat the intervertebral joints.

The following and final piece of the caudal vertebral column is very well preserved, with the exception of the very last and smallest end-member, both on the part and, in part, on the corresponding counterpart, which, as we have seen above, contains the positive of the head, Pl. III, Fig. 1. The anterior part of the former shows the impression of 16 vertebrae, ca_{32} to ca_{47}, with a length of 17.5 cm, preceeded and succeeded also by a half[-*vertebra*]. The counterpart contains the bony substance of its 15. The individual vertebrae, in respect of the length and height of their centra as well as the length of their neural and haemal spines, diminish only very gradually posteriorly. The following end-piece of the caudal vertebral column, in contrast, is like the section preceeding it. It is namely provided to us as a positive on the part, that is, as actual bony material, whereas the corresponding counterpart, which would bear the impression, is missing entirely. The length of this section is 21 cm, including an estimation of the non-preserved smallest elements of the tip of the tail. One can estimate the count of its vertebrae, the latter included, at about 50. One sees, already on the vertebrae preceeding the gap, that the transverse processes become progressively shorter and narrower. Thereafter they disappear entirely, and on the final piece they are no more than weak lateral bosses or are no longer discernible at all. An identical condition of the zygapophyses obtains, which shorten dramatically, so that at last the articular joint is limited to the vertebral centra. At the same time the anterior concave and posterior convex articular surfaces of the vertebral centra become progressively flatter; indeed, near the end of the tail they acquire at last a character reminiscent of the skeleton of fishes. Neural and haemal spines retain their form, but diminish constantly in respect of size unto the smallest element near the tail tip, which finally consists only of very delicate ["zarten"] little rods of bone.

Shoulders and forelimbs.

Even an only tolerably recognizeable or articulated shoulder girdle is no longer present on our slab. As the rib cage has suffered terrible destruction and the separation of its elements, so that only a few speculations about its construction can be expressed, so too are both shoulder girdles in so poor a preservational state that extremely little can be inferred from the slab about their form. This applies both to the right shoulder and, to an even greater degree, to the left one. Far to the side, over 6 cm from the vertebral column, approximately at the level of the fourth dorsal vertebra, one sees several smooth, uneven, undulating bony plates from the first [*the right*] girdle, which are partly encrusted and overlain by the capitulum of the humerus. This [*the capitulum*] is separated from its articular fossa and shoved up onto it next to the ends of ribs and fragments. The edges of the aforementioned bony plates are no longer recognizable; only the little bony plates lying behind the capitulum show a marginal embayment reminiscent of those of the raven-bone, or coracoid. The adjacent little bony plates would then be assigned to the scapula and its partly ossified margin, which continues further. Weak conjecture with regard to the clavicle and the episternum attached to it were previously expressed. On the left side, in the region between the fourth and sixth dorsal vertebrae, there exists only an agglomeration of flat, little bony plates, permeated by cracks or fragmented, under which there appears a somewhat clearer one [*agglomeration?*]. It [*the agglomeration?*] is bounded on the right by a half-moon–shaped curve and appears to derive from the scapula, on whose left side a portion appears to indicate the articular fossa for the shoulder joint ["an deren linker Seite ein Antheil davon die Gelenkpfanne für das Schultergelenk zu bezeichnen scheint"], while the posteriorly adjacent part would belong to the coracoid, which, as is known, helps construct the glenoid fossa in combination with the scapula. The upper or proximal articular head of the humerus would then be interpreted as still *in situ*, that is, lying in the articular fossa, also entirely consistent with its form and surroundings on our object. Posteriorly, triangular pieces of the stone are missing, together with any possible inclusions [i.e., *bone*], which were apparently lost during the recovery of the slab in the quarry.

Both forelimbs, especially on the left side, are fairly well preserved, each in its three segments, the upper arm, the forearm and the hand. The right one is bent at the elbow, the left stretched out straight. Both turn their anterior or ventral side ["ihre vordere oder ventrale Seite"] to the observer.

The upper arm bone, or humerus (hu.), is a robust, fairly straight long-bone about 4.5 cm in length, expanded at the ends, measuring 1.4 cm proximally, 1.3 cm distally, and nearly half as narrow in the middle, at 7 mm. Its head is oval, little distinct from the diaphysis, and shows lateral tuberosities that served for muscle attachment. The distal end, as clearly discerned on the left side, has a trochanter laterally for articulation with a correspondingly depressed articular fossa on the upper, proximal end of the radius, and a more protrusive one medially, the division of the elbow-joint, probably trochlear, for the proximal end of the ulna. A depressed place on the anterior or ventral side of the humerus, which is visible on the slab, divides these two articular parts, while the dorsal or posterior surface is sunk into the stone and is not visible.

The forearm, or antebrachium, is shorter than the upper arm, namely 3.5 cm long, and consists, as usual, of the radius (ra.) and the ulna (ul.), which are separated by a significant interossial space that distally reaches 8 mm. It is, in particular, only their proximal ends at the elbow that are united, whereas distally carpals are interposed between the ends of the radius and ulna. The radius is somewhat laterally curved, and the ulna extends fairly straight. The mechanism for the rotation of the radius to the ulna at the upper, proximal end of both, which doubtlessly obtained in the living animal, cannot be discerned on the stone. A patella ulnaris or the olecranon of the ulna is likewise not visible, structures that, on the extensor surface of the arm, now lie sunken into the stone slab.

The third section of the forelimb, the hand or manus, is composed of three further pieces: the carpus, the metacarpus, and the fingers or digits.

On the left hand the components of the carpus (cp.) are rather completely preserved, and more clearly in the original than they are reproduced in the photograph. One can see, best on the left side, the two rows of short, thick little bones, three in the proximal row: the radiale, for articualation with the distal end of the radius, and the ulnare, for articulation with the ulna. Between both the intermedium or centrale is interposed like a wedge, while the pisiform attaches to the ulna and simultaneously to the carpals laterally as a so-called sesamoid.

The second, distal row of carpals consists of five pieces; they are terms carpals 1 through 5. Carpal 1 borders the radius proximally, the centrale laterally, and the first metacarpal distally. Carpals 2 through 5 are arrayed one after the other in such a way that they articulate distally with the proximal ends of the neighboring metacarpals and proximally with carpal 1, the centrale and the ulnare.

The metacarpals (mcp.), likewise five in number, are short "long-bones" ["Röhrenknochen"] whose broader proximal ends have deepened articular surfaces for the reception of the carpals just named, while their thickened distal ends show heads ["Gelenkköpfe"], which serve for the articulation of proximal phalanges.

The fingers, or digiti manus, also constitute short "long-bones," which are somewhat thinner in the middle than at the ends. They are of unequal length. The longest (fourth) finger measures 5.2 cm, the shortest (first) 2.7 cm. Because their bones lie in rows, one after the other, they have received the name phalanges. The first finger has 2, the second 3, the third 4, the fourth 5 and the fifth again 3 phalanges.[37] Their proximal ends, broader relative to the diaphyses, have concave articular surfaces for the reception of the convex heads of the appertaining metacarpals; the distal end of the phalanx following the metacarpal, as with all further phalanges, is rounded off and provided with a groove for the articulation of the proximal end of the next member, which shows an eminence corresponding to the groove and neighboring depressions, which constitutes a so-called saddle-joint. A similar joint one also finds, for example, in man between the proximal end of the metatarsus of the thumb and the os multangulum majus that articulates with it. The last phalanx of each finger ends in a small, ventrally curved point, which was provided with a horny claw.

Pelvis and hind-limbs.

Previously, in the description of the sacrum, it was emphasized that the underside of the two sacral vertebrae, like that of the adjacent dorsal vertebrae, are entirely exposed, whereas in the normal condition of the skeleton, they would have been covered by the paired bones of the pelvis—united at a symphysis on the midline—and in particular by the os pubis anteriorly, by the os ischii posteriorly, and further laterally, more or less, by the ilium. The pelvic girdle, however, is not given to us but rather divided into its consituents; these themselves, however, were for the most part dispersed and lost, except for tiny remains. For only the ilia, or ossa ilii, of both sides are still present, if in an entirely different position. They appear as thin, irregularly elongate, triangular plates of bone whose thickened, normally anteroventrally directed base, as is generally known, participated in the building of the acetabulum with the two other pelvic bones, whereas the upper, thinned, somewhat sharp, posterodorsally directed end was connected laterally to the sacrum on its two strong, connected transverse processes, probably by synchrondroses in life. Both ilia lie to the side of the vertebral column, separated from their places of articulation: the right one—on the part—against and beneath the upper leg-bone and, further, on the proximal end of the fibula, with the tip directed posterolaterally; the left one, with its base abutting on the vertebral column, extends laterally and somewhat posteriorly over the proximal piece of the left femur, with the tip directed toward the proximal end of the fibula. The left ilium is located on the adjacent, accessory piece of the part that was separated by the longitudinal break at the vertebral column.

Nothing remains of the os pubis on our slab.

A trace of the os ischii may be indicated, though very dubiously, on the counterpart of the anterior-most piece of the caudal vertebral column, in particular an impression in the calcareous shale. This presents a short, irregular rectangle, its sides somewhat embayed in the middle, the corners on the other hand a little drawn forwards ["die Ecken aber ein wenig vorgezogen"]. It has in form a similarity to the outline of an ischium; only for the uncertainty of the identification did I abstain from indicating it in any way on the figures of the plates.

The hind-limbs themselves, like the forelimbs, consist of three sections each, namely, the upper leg-bone, or femur, the shank, or crus (tibia and fibula), and the foot, or pes. It is their flexor surfaces that are exposed at the level of the stony slab. Thus, the hollows of the knee face upward, the tibiae lateral, the fibulae medial.

The upper leg-bone, or femur (fe.), at 5.5 cm long, is the most robust long bone of the entire skeleton. It exceeds the humerus in length by 10 mm. On our (main and accessory) parts the osseous tissue is preserved in part, namely, somewhat less than half in each, and in particular, the proximal end of the right one and the distal end of the left. The remainder is only represented by more or less distinct impressions. The proximal, upper end of the right femur clearly shows a part of the spheroidal capitulum, then the neck and, under it, two of the trochanters as muscle processes ["als Muskelfortsätze"]; these are, namely, a large one laterally, the T. medius, and a smaller one medially, the T. anterior. Further ventrally, the body or middle piece [*diaphysis*], provided with longitudinal grooves and streak-like eminences [i.e., *flutings*], narrows somewhat and is then broken transversely, from which the impression of its posterior surface continues further backward over the fibula, on top of which the femur had been shoved. As a result of this condition, as well as the aforementioned apposition of the ilium, the interpretation of its relations is made rather difficult. On the left side, the proximal end of the femur is partly covered by the left ilium and partly encrusted; thereafter follows a part of the impression of its middle piece [*diaphysis*] and further still its distal end with the articular surface for the tibia and laterally for the fibula.

The shank has the same length as the forearm, 35 mm, but is 20 mm shorter than the femur and consists, as usual, of the lateral tibia and the medial fibula. Both are separated by an interosseal space, just like the bones of the forearm, so that their lower, distal ends do not connect and only the upper, proximal ends articulate with one another.

The shin-bone, or tibia (ti.), is conspicuously more robust than the fibula—twice as wide as it—and proximally it shows the two articular tuberosities of the knee and, between them, a depression; on the middle piece [*diaphysis*] are flutings, and distally there is a longish, transverse articular surface for the tibiotarsal or the astragalus.

The fibula (fi.) has almost the same length as the tibia. Its rounded, upper or proximal end, on both the right and left sides, is more or less displaced and removed from its connection with the femur and the tibia. Distally, it connects with the fibulotarsal (calcaneum). One of the small bones that, in lizards, are present in and around the knee joint is clearly visible on the left side between the two upper capitula of the crural bones; the knee-cap, or patella tibialis, appears to project beneath the ball-like articular surface at the femur.

The ankle bones, or ossa tarsi (ta.), are somewhat removed from their normal position by the pulling apart of the distal ends of the two leg bones. One recognizes, however, especially on the right side, the bone, shifted inward (medially) and therefore separated from the tibia and clinging to the fibula, that represents the first row of tarsals and according to the older view of Cuvier and Owen[38], in the sense of human anatomy, was regarded as astragalus (tibiotarsal) and as calcaneus (fibulotarsal), tightly linked or united as one bone [*fused*]. According to the studies of Gegenbaur[39], however, it arose from a fusion of four primary elements—the tibiale, intermedium and centrale on the one side, the fibulare (calcaneus) on the other—and was termed by him the calcaneo-astragalo-scaphoideum. One sees its connection with the fibula quite distinctly on the right foot. The connection was in any case, together with the tibia, a rather tight one, for the movement of the foot at the lower shank, like in all related animals, took place at the intertarsal joint.

The second row of tarsal bones on the left is clearly distinguished from the metatarsals, but on the right side they are shoved up somewhat at their proximal ends, such that here, individual little bones are removed from their position and connections. One sees, however, beginning medially, i.e. on the fibular side, a massive bone, the cuboid (digito-tarsal 4–5 *tum* Brühl), which follows on the third tarsal (ectocuneiform). Nothing can be discerned of the second tarsal (mesocuneiform) or the first. These may well already have fused with the proximal ends of metatarsals II and I, especially the first tarsal. A short, conspicuously wide and arched bone borders laterally on the cuboid and is viewed by Hoffmann[40] as the fifth tarsal. Then the fifth toe would only have three phalanges, because the immediately following element would be considered as metatarsus. Otherwise this bone is given in comparative anatomy as metatarsal V, whereby four phalanges are attributed to the fifth toe.

The first four middle foot-bones, or ossa metatarsalia (mta.), are rather uniform in their shape and form. There are longish, thin “long-bones” [“Röhrenknochen”] whose proximal ends articulate with the tarsals. On the right side, as noted, on account of the resultant displacement [“wegen erfolgter Verschiebung”], these joints are not visible on our object. On the left side, in contrast, the same are more distinct, and one sees their proximal ends in connection with the articular surfaces of the tarsus; namely, metatarsals I and II articulate with the tibiotarsal (astragalus), and metatarsals II and III with tarsal 3, the latter of which also borders medially on the cuboid, and this cuboid is distally in connection with the fourth metatarsal and medially with the fifth. The last [*metatarsal*] is, as just mentioned, short and wide, with a medial bend that produces a protrusion [“Vorsprung”] and is consequently totally different from the other metatarsals I–IV. The length of the latter [*four*] is very unequal; they come to 13 mm for the first and shortest, 15 mm for the second, 18 mm for the third, and 19 mm for the fourth and longest.

The toes, or digiti pedis, are all of a concordant nature with one another and with the fingers; only their phalanges are somewhat longer. The fourth toe, including the metatarsals [sic], measures 63 mm; it is thus 11 mm longer than the fourth and longest finger, which measures only 52 mm. Because the fifth toe, if one does not share the view of Hoffmann, mentioned above, of a fibular appendage, has four phalanges—that is, one more than the fifth finger—the phalangeal formula for the foot, from the first through fifth toes, is expressed by the number series 2, 3, 4, 5, 4, counted from the lateral or outer side to the medial [*as preserved*], whereas for the fingers of the hand in succession the numbers 2, 3, 4, 5, 3 apply. The terminal phalanges are, like in the forelimbs, slightly ventrally curved, pointed, and somewhat laterally compressed and were in life provided with horny claws.

If one compares the two pairs of anterior limbs [sic] with one another, the forelimb appears somewhat shorter than the hind-limb. The length ratio of fore- to hind-limbs is 9:11. Even the hand is somewhat smaller than the foot; the ratio of these is 11:15. The upper arm is shorter than the upper leg, and the ratio of the lengths of the two is 9:11. The forearm and shank are equally long, 3.5 cm. Their appropriately structured [“zweckmässig gegliederten”] fingers and toes, five each in number, with their strong claws made them adequate [“befähigten sie”] for walking on land; likewise, their broad and long palms and soles were for movement in water and were also strongly supported by the long, tall, powerful, and probably laterally compressed tail, that is, an excellent rudder organ.

*   *
*

With regard to the systematic position of our animal, there can be no doubt that it must be counted among the order of the scaled lizards, *Lepidosauria* [=*Squamata of today*], although nothing remains to us of its integument.

The procoelous nature of its vertebrae, the moveable quadrate attached only proximally by means of a suspensorium, the simple joint at which the unicapitate ribs articulate with the transverse processes of the vertebrae, and finally the absence of so-called gastralia, i.e., ossified strips of connective tissue, such as occur in other Sauria, for example in the Rhynchocephalia, from which they [*the "Lepidosauria,"* i.e.*, Squamata*] probably evolved and which they liken in the external appearance of the body and in the structure of the interior.

With regard to the suborder into which it should be placed, the presence of limbs rules out the limbless ["fusslosen"] Ophidia; it further distances it [*the animal*] also from the Pythonomorpha, whose limbs—flippers ["Ruderfüsse"] especially adapted for swimming, both anteriorly and posteriorly (less so here) formed like oars, exquisitely shortened, broad and flattened—are composed of flat elements never capable of rotation and lying throughout in one plane (one surface). Our Lesina fossil has five-toed, claw-bearing walking-feet ["Gehfüsse"].

The fossil from Lesina does indeed agree in the important and singular character of the remarkable dentition with the Pythonomorpha, although these also display a toothed pterygoid; only the last-named, extinct, mighty sea-monsters still differ most considerably in their extraordinarily elongate body-form and an enormously long body cavity surrounded by many short, strongly curved ribs, whereas in our animal this cavity is not conspicuously long and is surrounded by numerous but not long ribs. The Pythonomorpha also usually have, like the snakes, special processes for the articular connection of the vertebrae, the zygosphenes and zygantra,[41] which the Lacertilia (*exc.* Iguanidis [*except Iguanidae?*]) lack.

As examples of the noted great length of the body, just *Mosasaurus* at 8 m (25 ft), *Clidastes* at 11 m, *Tylosaurus dispelor* Cope at well over 30 m (100 ft) length may be named; most impressive dimensions, which other species of this suborder also have, and from which our fossil, in constrast, at only 1.4 m length, strongly departs. Moreover, the sacrum of the Pythonomorpha consists of only one vertebra, that of our animal of two; the Pythonomorpha lack the columella [*epipterygoid*], which is present here.[42]

The suborder *Dolichosauria*, or long-necked lizards, which possess a greater number of cervical vertebrae, always at least over nine ["stets mindestens über neun"], can likewise not be considered for our lizard, for it shows only eight cervical vertebrae.

That leaves, therefore, only the suborder Lacertilia into which we can place the fossil from Lesina. The body shape, not stretched in any conspicuous way and of a moderate length that also occurs in living forms, the extremely long tail, the rod-like columella, the limbs constructed as obvious walking-feet, with five claw-bearing toes, all amply justify this placement.[43]

But of all Lacertilia, our animal is closest to the monitor lizards, or Varanidae, in its form and body-shape, insofar as the skeleton permits one to determine them, and in particular in the elongate head, the smooth anterior frontal and neighboring posterior parietal regions, the rounded orbits, the azygous parietal, in the supratemporal fossa that extends up onto the dorsal surface of the skull, in the nearly quadrilateral occiput and the long parotic processes that extend from it, in the lack of lumbar vertebrae, and finally in the suspensorium for the quadrate.

Because of the construction of the skeleton, one would be nearly tempted to assign it [*our animal*] immediately to this speciose ["formenreich"] lineage, if not for the nature of its teeth, which are attached to supporting bases and wholly resemble those of the Pythonomorpha; their nature namely excludes our animal from the genus *Varanus* and all other Lacertilia. Our animal, on account of this remarkable character, is so very special and peculiar among the latter [*Lacertilia*], that it must be seen as its own genus, if not as representative of its own family.

The characters presented in the previous description render this fossil superior, preeminent among all those extinct animal forms thus far excavated on the island of Lesina, and in particular among the Reptilia, in respect of its size and beauty as well as its state of preservation and finally the special connection to related groups in the zoological system. It thus deserves, by all rights and above all others, the term Lesina-Saurian, *κατ' ἐξοχήν*, in the true sense. But the expression "*lesinensis*" is now already multiply in use for fishes, ferns, and the like and was assigned by me myself as a species name in 1873 to *Hydrosaurus* (description *loc. cit.*), so another appellation might more appropriately be coined, except that something like "*Lesinosaurus*," bilingually composed, would not fully adhere to the more stringent linguistic requirements of word-construction. The Italian name for the island, however, derives from a comparison that is supposed to have been made between an awl or *Pfriem*, which tool in Italian is called "lesina," and the island's peculiar, long, stretched-out shape. The Greeks named this tool "*τὸ ὀπήτιον*," which would give *Opetiosaurus* for the name of the new genus and which I now take the liberty of proposing, so cleaving to the generic name a commemoration of the splendid southern island with its precious, exquisite paleontological discoveries. Concerning the name of the species, the obvious course of action is to preserve in it [*the name*] our grateful remembrance of the active and highly honored student of varied fields of natural science, Mr. Gregor Bucchich of Lesina, to whose most laudably known eagerness and lively interest in the extraction and preservation of the "mementos of creation" ["Denkmünzen der Schöpfung"] we owe, beside many others, also this marvelous petrfaction, *Opetiosaurus Bucchichi*, one of the most precious treasures of the splendid collections of the Royal Imperial Geological Institute.

Although the special peculiarity of *Opetiosaurus*—in its remarkable dentition—distinguishes it in a salient way from all Varanidae and strongly differentiates it from all fossil and Recent Lacertilia known thus far, so that an identification with other Sauria previously found in the Chalk formation, be they in the *plattenkalke* of Lesina or the somewhat older carbonaceous shales of Komen (Barremian) and so forth, cannot be considered, yet a short differentiation with regard to other characters of these already known fossil saurians may be given.

Mesoleptos Zendrini Cornalia, 1851 from Komen, in the colleciton of the Museo civico di Storia naturale in Milan, belongs among the older discoveries. It is characterized by its posteriorly conspicuously narrowed vertebrae, which attribute also found expression in its name. *Opetiosaurus* in no way shows the same. A similar petrefaction from Lesina, which Kramberger[44] mentions, is found in the collection of the instructor-widow Mrs. Antonia Novak in Eso Grande at ["bei"] Zara.

Acteosaurus Tomasinii Herm[ann] von Meyer, 1860, from the same locality, in the Museo civico in Trieste, is a dolichosaur with 27 dorsal vertebrae, nearly exactly equally long ribs, and furthermore with extremely shortened forelimbs, whereby the ratio of the length of the humerus to that of the femur is 1:2, and that of the middle to the proximal sections of the forelimb is 5:7, and 4:7 in the hind-limb, whereas in *Opetiosaurus* the ratio of the humerus to the femur is 9:11 and those of the aforementioned sections 7:9 and 7:11.

Hydrosaurus lesinensis Kornhuber, 1873, in the collections of the Royal Imperial Geological Institute, has 30 dorsal vertebrae and much more weakly developed forelimbs and a smaller head than *Opetiosaurus*.

Adriosaurus Suessi Seley [sic, *for "Seeley"*], 1881, from Komen, in the geological collection of the University of Vienna, is similar to the latter two but is a much smaller animal, although full-grown, and is distinguished from *Opetiosaurus* by short, compact ["gedrungene"] vertebrae that are convex length-wise ["der Länge nach convexe"] and by very robust ribs that are rather alike.

Carsosaurus Marchesettii Kornhumber, 1893, from Komen, in the Museo civico of Trieste, has nearly equally developed upper arm- and leg-bones, with a ratio of 16:17, whereas the forarm and shank have the same length, and the ratio of forearm to upper arm is 5:8.

There is now only *Aigialosaurus dalmaticus* of Prof. Dr. Carl Kramberger-Gorjanović [sic] in Agram to consider. This animal likewise derives from the fish- and reptile-producing *plattenkalke* of the island of Lesina, was discovered by a peasant ["Bauer"] of Vrbanj, and came into the possession of the now-deceased Mr. J. Novak, teacher in Zara. Prof. Kramberger-Gorjanović [sic] gave a careful description of it with illustrations.[45] *Aigialosaurus* has some similarities to our new fossil; however, its head is much more tapered anteriorly (is sharply wedge-shaped), the parietal is broader in the middle, the mandible much lower ["niedriger"], the anteriorly displaced quadrate thinner and provided dorsally with a posteriorly directed, triangular process, only seven cervical vertebrae (whereas the dorsal vertebral count agrees with that of our animal, namely, twenty), the ribs are significantly shorter and the caudal vertebrae lower ["niedriger"]. Nothing appears to have been preserved of the teeth. At least, there is no mention of them in Kramberger. In case one should like so to refer to a steep, cone-shaped structure with a flat (broken-off?) tip on the dentary of the right mandible, then one could attribute to *Aigialosaurus* a very different dentition than in our new fossil, just like in other Lacertilia. It is not at all easy, without examination of the original slab, to form a sound judgment of one's own from observation of the lithographic figure alone. Thus, one could be disposed to view the structures joined to the cervical vertebrae of Prof. Kramberger's *Aigialosaurus* and which he identified as hypapophyses instead as cervical ribs, because the same arise from the anterior end of the vertebral centra at the transverse processes, which lie next to the prezygapophyses, exactly as is apparent in the cervical ribs of the fifth through seventh cervical vertebrae from the labels on the same plate, whereas the hypapophyses of the Lacertidae, Scincoidea and so forth, except for the Agamidae,[46] and furthermore those of the Pythonomorpha, are always applied beneath the articular condyle, and thus posteriorly on the vertebra.[47] Whatever the case may be, the hypapophyses of our new petrefaction have a form and position completely different from that of *Aigialosaurus*, as described earlier, and occur until the eighth cervical vertebra.

According to the reconstruction of Kramberger, his *Aigialosaurus*, in my opinion, could belong with no little probability to the family *Varanidae* D[úmeril] et B[ibron], where, of course, occur many fossil annd Recent forms conforming to "Sauri longo, acuto capite et aequis fere extremitatibus" and in which the emphasized diagnostic characters ["unterscheidend hervorgehobenen Charaktere": sic?] of Kramberger's group *Ophiosauria*[48] are fully met. Kramberger[49] namely finds these differences, which at the same time are supposed to reflect the transition of *Aigialosaurus* to the Pythonomorpha, to be: "1. in the greatly stretched body, 2. in the clearly distinct tendency toward reduction of the limbs, 3. in the presence of hypapophyses and 4. in the nature of the quadrate." To begin with, as far as the stretching of the body is concerned, the length of *Aigialosaurus*, at 1.34 m—that is, a body-length that, in Varanidae, is both common among and exceeded (*Varanus arenarius* 1 m, *V. niloticus* 1.5 to 1.9 m, *V. bivittatus* 1.5 m, *V. albogularis* [sic] 1.7 m)—has no similarity to the enormous body lengths of 10 to 30 m in the Pythonomorpha[50] and so cannot support any phylogenetic relationship of *Aigialosaurus* to these latter. In the limbs of both, however, there exists such a great contrast between the clearly distinct, claw-bearing walking-feet of *Aigialosaurus* and the unclawed flippers ("fins" of Cope[51]) of the Pythonomorpha, in which, moreover, the forelimbs generally exceed the hind-limbs, the reverse of the condition in Varanidae, so that this character also breaks down, particularly as the limbs show no apparent tendency toward reduction in *Aigialosaurus* either but rather have the same ratios as in the majority of monitor lizards.

Regarding further the presence of the hypapophyses on the cervical vertebrae, this constitutes no similarity with the order Pythonomorpha, for these [*hypapophyses*] do not represent a diagnostic character of the latter but rather also occur in a similar way in the Lacertilia. If these appear more conspicuous in the genus *Clidastes*, where Cope[52] has figured them, this is probably explained by the significant size of this prehistorical American sea-monster. These hypapophyses appear so constantly in the Lacertilia that Calori[53] even bases on them the distinction between cervical vertebrae, which possess them, and dorsal vertebrae, which lack them. C. K. Hoffmann[54] also gives these as a general character of the cervical vertebrae in Sauria. I myself[55] already described them in the year 1873, and not merely, as Kramberger *loc. cit.* p. 18 (91) and 30 (103) says, on the second, but also on the other cervical vertebrae of *Hydrosaurus lesinensis*. They are really true hypapophyses and not, like Kramberger states, something like the parapophyses of Owen.[56] For the latter appear laterally on the centrum, and paired; they correspond to the little rib capitula or the lower transverse process (Joh. Müller), which is the anterior root of the processus transversus (Soemering).[57] The hypapophyses, in constrast, arise, like in our saurian, on the midline beneath the vertebral centrum and are unpaired. Fr. Siebenrock[58] as well has expressed his view on the hypapophyses in the same sense.

Lastly, I am not in a position to add to the ascribed diagnostic value of the "entirely different form," as Kramberger stated, of the quadrate in *Aigialosaurus*, for the quadrate takes on the most various, often recurring ["wiederkehrend"] forms in the different suborders, families, genera and species of the Lepidosauria. Thus, the form of quadrate in our new Lesina fossil, as already described in the observations on the head, as well as that of *Aigialosaurus* probably has a similarity with the bone of the same name in the Pythonomorpha, which Cope[59] figures from no fewer than 17 species in various positions, of which v. Zittel, after Owen and Cope, provides outstanding illustrations in Fig. 546 and 547 on p. 616 of his *Palaeozoologie* III and *Grundzüge der Palaeontologie*, Munich and Lepzig 1895, p. 645. But v. Zittel also noted, in the same place, that this quadrate "is most reminiscent in its form to that of the lizards and varies enormously in the various genera." Indeed, we are reminded of it in *Monitor niloticus*, where it possesses an even more prismatic form, by the shallow excavation on its lateral surface (*creusé en demi canal* Cuvier[60]). In the genus *Lacerta* it was fittingly compared with an outer ear.[61] *Lacerta agilis* has a curved, dorsally rounded, D-shaped quadrate,[62] and *Lacerta viridis* has a completely similar one.[63] One cannot therefore recognize, in this character, any special phylogenetic relationship of the Lesina saurians to the Pythonomorpha, particularly as Cope himself, in the diagnostic characters on which he based this new order in the subclass *Streptostylica*,[64] made no mention of it.

Thus, the erection of a monotypic family "*Aigialosauridae*" cannot be deemed advisable for the reasons stated. A similarity of the Krambergerian saurian with the Pythonomorpha appears to me to lie in the formation of the peculiarly tapering, wedge-shaped head, which is reminiscent of Cope's[65] representation. This condition, in addition to the characters listed above, may well, in complete agreement in features with the family Varanidae, justify the adoption of a new genus "*Aigialosaurus*."

The foregoing, elaborated argument will have provided the proof that the saurians discovered thus far in the chalk formation of Istria and Dalmatia generally bear all the varanid characters, apart from special features, and that even Kramberger's *Aigialosaurus* as well as the new *Opetiosaurus* must be counted among them. If a transitional group between the Varanidae and the Pythonomorpha should be adopted, then such would best be represented by the new genus *Opetiosaurus*, for this animal, in its special, distinctive dentition among all other varanid-characters, embodies a completely natural, closer phylogenetic connection to the Pythonomorpha.

Finally, I cannot refrain from addressing ["begrüssen"] again most graciously those monsieurs who underwrote my work with their kind support in so many ways. Above all I am indebted to the Director of the Royal Imperial Geological Institute, my highly honored friend of many years, Mr. *Hofrath* Dr. G. Stache, for the allocation of the object; to Mr. *Bergrath* Friedr. Teller, for much good advice and for his friendly agency in the execution of the lithography in Plates II and III; and to Mr. Librarian Dr. Anton Matosch for multiple, kind *Mühewaltung*; further to the royal and imperial Director of the *k. k. naturhistorischen Hofmuseum* Mr. *Hofrath* Dr. Franz Steindachner and the royal and imperial Curator of the same, Mr. Friedr. Siebenrock for the allowance of literature and of comparative material of skeletal parts; finally to my excellent, erstwhile pupil, dear friend and colleague, Mr. *Hofrath* Prof. Dr. Franz Toula, for the work-room most kindly offered to me in the offices ["Örtlichkeiten"] of the *Lehrkanzel* for Mineralogy and Geology at Wiener k. k. Polytechnic, surrounded by the rich book treasures of the same, which made it possible and much easier for me to execute, in my *dermalen* and intermittent stays in Vienna, the undertaken task. I fulfill a dear and pleasant duty in allowing myself, in conclusion, to give expression to my feelings of most heart-felt and sincere gratitude to the honored sirs named above.

Comprehensive summary

of

Admeasurements of the more important parts of the skeleton of *Opetiosaurus Bucchichi* and ratios of some of the same

	Meters
Length of the head	0.150
Width “ “ “ at maximal separation of the two jugals	0.060
“ “ “ “ at the posterior end (separation of the ends of the mandibles)	0.075
Length of the parietal	0.025
Width “ “ “ between the proximal ends of the two supratemporal processes	0.012
Smallest width of the parietal between the two concave lateral margins	0.007
Greatest “ “ “ “ (and frontals) at the frontoparietal suture	0.030
Length of the frontal on the counterpart, *circa*	0.040
“ “ “ “ on the negative of the part from nasal to frontoparietal suture	0.050
Width of the pair of frontals between the two prefrontals in the middle	0.009
“ “ “ “ “ “ “ the inner orbital margins	0.012
Length of the prefrontal	0.027
Greatest width of the prefrontal	0.008
Length of the postorbitofrontal (greatest, with the processes)	0.025
Width “ “ “ (greatest, with the processes)	0.015
Length of the orbit	0.035
Width “ “ “	0.024
Length of the supraoccipital	0.005
“ “ “ quadrate, so far as it appears over the articular	0.022
Greatest width of the quadrate	0.017
Width of the quadrate at the position of the articular	0.012
Length of the suspensorium of the quadrate (su. te., sq., pr. parot.)	0.035
Distance of the upper (proximal) margin of the quadrate from the median groove of the parietal	0.020
Thickness of the maxilla at the broken place (on the counterpart, Pl. III)	0.006
Width of the skull at this fracture	0.035
Length of the impression of the palate corresponding to the lost piece of the snout	0.045
Distance of the tip of the snout from the anterior end of the supraorbital [*palpebral?*]	0.055
“ “ “ “ “ “ “ from the frontoparietal suture	0.093
“ “ “ “ “ “ “ from the posterior end of the parietal	0.120
Length of the maxilla (on the negative) from the tip of the snout to the prefrontal	0.050
“ “ “ lower jaw [*mandible*]	0.150
Height of the lower jaw from the tip of the coronoid process straight down to the inferior margin of the angular	0.028
Length of the dentary from the tip to the middle suture in the mandibular ramus	0.082
“ “ “ opercular from the tip to the middle suture in the mandibular ramus	0.083
Height of the coronoid from tip to base	0.013
Greatest length of the coronoid near its base	0.024
Height of the mandibular ramus at the fracture in front of the quadrate	0.007
Length of the mandibular ramus, so far as bone is present	0.031
“ “ “ “ “ (impression) from the fracture to the middle suture	0.036
Height of the angular (maximal) on the negative of the main slab	0.008
“ “ “ surangular (maximal) on the negative of the main slab	0.005
“ “ “ anterior half of the Md (d + op) from the middle, angled suture	0.018
“ “ “ “ “ “ “ “ “ in the middle of this half	0.008
“ “ “ “ “ “ “ “ “ anteriorly near the tip	0.003
Distance between the two posterior ends of the mandibular rami	0.075

Measurements of different vertebrae, their processes and ribs may be found in the text.

Number of cervical vertebrae on the counterpart, attached to the occiput 3
“ “ “ “ “ “ main slab, very distorted 5
“ “ dorsal vertebrae 20
“ “ lumbar vertebrae..0
“ “ sacral vertebrae...2
“ “ all vertebrae of the torso 30
“ “ “ caudal vertebrae, the anterior-most on the main slab 7
“ “ “ caudal vertebrae, the following ones, that is, the 8th, 9th and 10th, on the smaller slab comprehensively...3[††]
Number of caudal vertebrae on the following two broken pieces of the slab, to which two counterparts, Pl. III, Fig. 3 and 4, also correspond 10
“ “ all caudal vertebrae, that probably were present in the cleft but now are missing entirely 11
“ “ all posterior caudal vertebrae in the caudal piece of the vertebral column stretched out straight on the main slab, the anterior negative part (impression of the counterpart), 1/2 then 16 then 1/2 again 17
“ “ all posterior-most caudal vertebrae, present as positives (the osseous tissue) on the main slab, with the small, last, distal-most element of the tail tip, which can only be counted approximately, *circa* 50
“ “ all caudal vertebrae, therefore, 98, or rounded to 100
“ “ all vertebrae combined 130

Length of the cervical section of the vertebral column (1st through 3rd vertebrae 0.020, 4th through 8th vertebrae 0.085) 0.105
“ “ “ dorsal section of the vertebral column 0.380
“ “ “ sacrum 0.032
“ “ “ torso, therefore 0.517
“ “ “ tail, anterior piece through the lost part of the stony slab (the cleft)............0.260
“ presumed of this cleft itself, along the direction of the curvature of the tail 0.120
“ “ “ tail section on the main part, anterior part as an impression (negative) on this slab 0.175...[*sum:*]
“ “ “ tail section, posterior (end-)part as a positive (osseous tissue) 0.21............0.385
“ “ “ whole tail 0.765
“ “ “ whole animal skeleton (the head, at 0.150, included) 1.432
Length of the upper arm bone (humerus) 0.045
Width “ “ upper arm bone at the proximal end 0.014
“ “ “ “ “ “ in the middle 0.007
“ “ “ “ “ “ at the distal end 0.013
Length of the forearm (antebrachium)..0.035
Width of the ulna at the proximal end 0.0075, of the radius there 0.005
“ “ “ “ in the middle ....0.004, “ “ “ “ 0.003
“ “ “ “ at the distal end ......0.006, “ “ “ “ 0.004
“ of the interosseal space as great as 0.008
Ratio of the length of the forearm to the upper arm 7:9
Length of the carpus, width unclear 0.005
Longest finger (the fourth)...0.052
Shortest finger (the first) 0.027
Length of the unguals, from 0.005–0.007
“ “ “ hand 0.055
“ “ “ forelimb 0.135

[††] Yes, he really did include this.

Length of the ilium	0.025
Width “ “ “ , proximally 0.008, distally	0.003
Length of the upper leg-bone (femur)	0.055
Width “ “ “ “ “ at the proximal end	0.013
“ “ “ “ “ “ in the middle	0.008
“ “ “ “ “ “ at the distal end	0.013
Length of the shank (crus)	0.035
Width of the tibia at the proximal end 0.09, of the fibula there	0.005
“ “ “ “ in the middle..........0.006, “ “ “ “	0.003
“ “ “ “ at the distal end......0.008, “ “ “ “	0.007
Interosseal space between the two, as wide as	0.008
Ratio of the length of the shank to the upper leg	7:11
“ “ “ “ “ “ upper arm to the upper leg	9:11
“ “ “ “ “ “ forearm to the shank	1:1
“ “ “ “ “ “ proximal and middle sections of the forearm to the length of the proximal together with the middle sections of the hind-limb	8:9
Length of the tarsus 0.011, its width	0.015
Longest toe (the fourth), without the metatarsal 0.044, with the metatarsal	0.063
Shortest toe (the first), “ “ “ 0.017, “ “ “	0.034
Length of the unguals, from	0.006–0.008
“ “ “ foot	0.075
“ “ “ hind-limb	0.165
Ratio of the length of the forelimb to the hindlimb	9:11
“ “ “ “ “ “ hand to the foot	11:15

Plate I.

A. Kornhuber: *Opetiosaurus Bucchichi*, a new fossil lizard from the lower chalk of Lesina in Dalmatia

Total view of the pieces of the part of the rock with the remains of the animal or their impressions, arranged according to their mutual relations and embedded in plaster of Paris, reproduced as a photograph at a ratio of nearly 9:10 of the natural size.

Plate I.

The fossil figured here was discovered, according to the exact statements of Dr. U. Söhle (*Jahrb[uch] d[er] k[aiserlich-]k[öniglichen] geol[ogischen] R[eichs]a[nstalt]* 1900, Vol. 50, Part 1, p. 43), who in the year 1899 devoted some time to geological studies on Lesina, in August of the indicated year and in particular in the pit belonging to Marino Vidos, 1.5 km NW from *Mte. Hum* near Verbosca. This stone quarry is, according to Söhle, about 10 m high and long and 6 m wide, and the layers of the *plattenkalk* dip 20–30° to the north.

The object, upon which the the photograph on Pl. I is based, consists of an 8- to 10-mm-thick calcareous shale plate, which, during excavation in the pit, was broken up into a larger main plate of 42 cm width and 33 cm height (in relation to the figure), that is, the most significant part of the picture, and into three smaller accessory plates. The main plate contains the head in the upper left, mostly as an impression (negative) of its upper surface, namely the skull roof, then the anterior part and the posterior end of the left mandibular ramus and the right mandiblewith the extremely remarkable, characteristic dentition. Beneath it also lies the posterior part of the tail (34 cm long in the figure), of which the anterior section (16 cm in length in the picture) is preserved as a negative and the remainder, up to the end of the tail, as a positive—that is, retaining the osseous tissue. Further down there follows the larger part of the torso. The animal being inverted, this appears with the under or abdominal surface of the 5 last cervical, 20 dorsal and 2 sacral vertebrae turned toward the observer. The cervical section of the vertebral column is strongly bent the left and posteriorly, the anterior dorsal vertebrae show a weak bending to the right, the following ones a moderate curve to the left. Of the caudal vertebrae, the 1st through 7th are only partly preserved, suggested on the lower left corner of this piece of the slab. Well preserved on the latter are the right forelimb, which, bent, lies near the tip of the tail, then the left forelimb, partly displaced onto the vertebral column and stretched out straight, and finally the right hind-limb with the especially beautifully formed bones of the foot. On a small, nearly equally *schenkelig*, triangular stone platelet, which adjoins the main plate diagonally and on the front-most part, is the left, hind-limb up to the tarsus and remnants of the caudal piece named above. Finally, in the left corner of the picture, two fragments of the plate are present, separated on the right by a fracture, which simultaneously forms the base of the aforementioned triangle and continues further posteriorly. They [*the fragments*] contain the left foot and the caudal vertebrae from the 8th to the 21st. The fracture, along which these two fragments abut, runs through the body of the 15th caudal vertebra. There follows a not insignificant cleft that arose from the loss of a piece of the slab, on which 11 caudal vertebrae were present and followed by the long, relatively straight piece of the tail found on the main slab.

The annotated Plate II provides more information on different particularities of the parts mentioned here.

The photograph of the stone slabs with the petrifaction—reassembled, set in plaster of Paris, and surrounded by a frame—was prepared with a ratio to natural size of 54:61. The size of the figure, therefore, is somewhat less than nine tenths of the original; that is, it is somewhat over one tenth reduced in the picture. Because the photograph and the schematic outline-drawing on Plate II, with the labels and so forth, are executed at precisely the same scale, an allowance should generally, and particularly in comparison with the figures on the lithographic Plate III, be made. The figures on this latter plate are namely produced at natural size and so in a relation of 1/1 with the stone.

My highly honored friend and colleague, Mr. *Hofrath* Prof. Dr. Jos[eph] Maria Eder, always happily prepared when it comes to advancing scientific goals, had the special kindness to have the photography of the stone slab executed in the Royal Imperial Graphical Teaching and Experimental Institut ["k. k. graphischen Lehr- und Versuchsanstalt"] in Vienna, which is under his direction. The taking of the photograph took place on the 5th of October 1900 in the most careful manner by monsieurs August Albert, *k.k.* Professor, and Anton Massak, *Werkmeister*, both active ["thätig"] in reproductive photography. The gelatin-plates were also prepared in this institute based on the negative of the very successful photography, and from them, test-photographs. The reproduction of the photographs then took place in the press of Max Jaffé in Vienna. It is an honor for me to express here the warmest, sincere gratitude of the *k. k.* Geological Institute and of myself to the monsieurs of that institute.

Plate II.

A. Kornhuber: *Opetiosaurus Bucchichi*, a new fossil lizard from the lower chalk of Lesina in Dalmatia

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Outline of the skeleton with labeling of its individual parts, or outline-drawing.

Plate II.

In the representation of the anatomical units of the skeleton of the fossil, the basic outlines were first reproduced from the photograph. However, it was from the smaller plates appended as a lithographic figure on Pl. III, which constitute the counterpart to portions of the larger part, that all that appeared useful for the more exact presentation of the bony framework was incorporated and drawn in the appropriate place in the outline-plate. Thus, many skull bones show only weak impressions in the photograph, or are partly encrusted by calcite and therefore difficult to recognize, whereas the counterpart, Pl. III, contains the positive of the skull, that is, the substance of the bone, and also reproduces each negative impression that appears more or less clearly on the part. The same also applies to the portions of the tail piece of the vertebral column, which extend from the 1st to 7th, then from the 8th to 14th and from the 15th to 21st caudal vertebrae. Here as well, the picture is made much clearer by a combination of drawings from the part and counterparts. The elements of the skeleton are designated with the first letters of their Latin names, as used in the text; the numbers indicate the succession of elements of the same name. They are provided in order of anatomical succession. In a footnote on page 15 of the contribution [*original pagination; here, endnote 37*], attention was previously called to a mistake in the labeling of Plate II, where on the fifth finger of the right hand an extra phalanx—four instead of three—was represented.

A. On the head:

b. o. basioccipital

s. o. supraoccipital
exo. exoccipital
pa. parietal
fo. pa. foramen parietal
sut. fr.-par. frontoparietal suture
po. f. postfrontal [*postorbitofrontal*]
pr. f. prefrontal
p. p. parietal process [*supratemporal process*]
p. parot. parotic process
pal. palatine
pt. pterygoid
tr. transversum [*ectopterygoid*]
su. orb. supraorbital [*palpebral?*]
s. t. supratemporal of Parker (=mastoid of Owen, Cuvier and others) [*squamosal*]
sq. squamosal [*supratemporal*]
q. quadrate of Huxley and others (=Pos tympanic of Cuvier, Owen and others)
na. nasal
mx. maxilla
pmx. premaxilla
ju. jugal
md. mandible
ar. articular
su. an. surangular
an. angular
op. opercular (=splenial of Owen)
d. dentary
cor. coronoid
col? columella [*epipterygoid*]

B. Vertebral column and ribs:

ce. cervical vertebrae
ce_1 to ce_3. first to third cervical vertebrae, attached to the skull
ce_4 to ce_8. fourth to eighth cervical vertebrae
hy. hypapophysis
co. ce. cervical ribs
do_1 to do_{20}. dorsal vertebrae
co. do. dorsal ribs
co. i. costae intermediae
co. st. costae sternales
sa_1. first sacral vertebra
sa_2. second sacral vertebra
ca. caudal vertebra
ca_1 to ca_7. first to seventh caudal vertebrae, the counterpart Fig. 2, Plate III
ca_8 to ca_{14}. eighth to fourteenth caudal vertebrae, the counterpart Fig. 3, Pl. III
ca_{15} to ca_{20}. fifteenth to twentieth caudal vertebrae, the counterpart Fig. 4, Pl. III
ca_{21} to ca_{31}. lost piece of the caudal vertebral column
ca_{32} to ca_{47}. on the part, the negative portion of the caudal vertebral column (=impression of the positive found on the counterpart)
ca_{48} to ca_{100}? end-piece of the caudal vertebral column
n. neurapophysis
nsp. neural spines
p. tr. transverse processes
h. haemapophysis
hsp. haemal spines

C. Shoulder girdle and forelimb:

ssc'. right ?suprascapula
sc'. right scapula; sc. remnants of the left shoulder
cr'. right coracoid
hu'. right humerus, hu. left
ra'. right radius, ra. left

ul’. right ulna, ul. left
cp’. carpus of the right hand, cp. the left
mcp’. metacarpus of the right hand, mcp. the left
ph’. phalanges of the right hand, ph. of the left
ph. u’. ungual phalanges of the right hand, ph. u. of the left

D. Pelvis and hind-limb:

il’. right ilium, il. left
fe’. right femur, fe. left
ti’. right tibia, ti. left
fi’. right fibula, fi. left
ta’. right tarsus, ta. left
mta’. right metatarsus, mta. left
ph. p’. right phalanges, ph. p. left
ph. p. u’. ungual phalanges of the right, ph. p. u. of the left

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Plate III.

A. Kornhuber: *Opetiosaurus Bucchichi*, a new fossil lizard from the lower chalk of Lesina in Dalmatia

Figures of the pieces of the counterpart of the fossil, which for the most part contain the remaining pieces as positives, that is, the osseous substance.

Plate III.

On Plate III, the four smaller pieces of stone fragments, which, in the locality of their discovery, lay on the pieces of the part that are figured photographically on Pl. I, were represented lithographically; these were entombed with the pieces of the part and left behind on them impressions (negatives) of the bony remains.

Fig. 1, the largest of the four counterpart pieces, shows the head in dorsal view, i.e., with the flat surfaces. It shows the occipital parts with the first three cervical vertebrae attached; the skull roof and the orbital region; the suspensorium, which bears the quadrate together with the mandible, which, in turn, shows tooth impressions; an impression of the roof of the mouth and of the columella. Next to it [*the skull?*] lies a piece of the caudal vertebral column (positive) from the 32nd to 48th vertebrae; in the picture, the anterior vertebrae with their processes lie in the lower right [“rechts unten”; sic?], the posterior ones in the upper left [“links nach oben”; sic?], where the especially well-preserved upper and lower spinous processes are seen. See more detailed comments thereon in the text, pages 4 and 5 [*original pagination; approximately the same here*] and cf. the outline-figure in reference to the head on Pl. II.

Fig. 2 is a smaller counterpart piece that belongs to the anterior-most section of the caudal vertebral column, where the most interfering destruction has taken place. It shows three vertebrae (positive), which are to be reckoned the 3rd, 4th and 5th caudal vertebrae. Cf. the text on page 13 [*original pagination; here, page 14*].

Fig. 3 and 4 are two precisely matching pieces of the counterpart which also contain caudal vertebrae (positive), in particular from the 8th to the 21st. The fracture along which they contact each other runs, as on the part, through the 15th caudal vertebra. The piece of Fig. 4 terminates, in the picture, on the left with the 20th caudal vertebra and with the place where the half of the 21st vertebra was located, though it is no longer present. Impressions or negatives on the part again correspond to the positives of these two pieces of the counterpart. The cleft, which corresponds to the entirely lost piece of the slab on which eleven vertebrae were preserved, follows the end of the counterpart fragment No. 4, at the lower left in the picture. See more detailed comments on this in the text on page 13 [*original pagination and here*].

All figures, 1 through 4, of this Plate III are drawn from the originals, at a scale corresponding to their natural size (1:1) on the stone and reproduced by printing.

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[1] [1,1] Through Bucchich's agency the Royal Imperial Geological Institute has previously obtained *Hydrosaurus lesinensis Krnhbr.* [Kornhuber] 1869; fishes: *Belonostomus* and *Holcodon lesinensis* 1882; and the fern *Sphenopteris lesinensis* 1895. Among Recent animal species, Bucchich discovered sponges: *Tethya Bucchichi O. Schmidt* 1885, *Amphoriscus Bucchichi V. v. Ebner* 1887, *Amphoriscus Gregorii v. Lendenfeld* 1891; furthermore worms: *Myzostoma Bucchichi v. Wagner* 1886; crustaceans: *Nicea Bucchichi Heller* 1865; insects: *Orellia Bucchichi v. Frauenfeld* 1867, *Rhacocleis Bucchichi v. Brunner* 1882; and fishes: *Gobius Bucchichi F. Steind.* 1870. Mr. Bucchich has also participated most enthusiastically and successfully during the [18]60s in the experiments begun by Prof. O. Schmidt on the artificial cultivation of sponges in Porto Socolizza north of Lesina. Products of these lines received their due attention at exhibitions in Graz and Trieste.

[2] [2,1] See Dr. U. Söhle: "Preliminary notice on the stratigraphic-geologic relationships of the island of Lesina" in *Verhandl[ungen] d[er] k[aiserlich]-k[öniglichen] R[eichs]a[nstalt]* 1889, p. 319, and *Jahrbuch* [*of the same*] 1900, p. 36: Söhle, "Geognostic-paleontological description of the island of Lesina."

[3] [2,2] Heckel: *Denkschriften der Wiener Akademie*, v. 1 – *Partsch in Petter's Dalmatia*, v. 1, p. 18.

[4] [2,3] Abbé Giovanni Battista (Alberto) Fortis: Viaggio in Dalmatia, 2 vols. Venice 1774. – Translated into German [by] Bern 1775.

[5] [2,4] l.c.

[6] [2,5] Heckel J. and Kner R.: "New contributions to the knowledge of the fossil fishes of Austria" in: *Denkschriften der Wiener Akademie, math[ematisch]-naturw[issenschaftliche] Cl[asse]*, vol. 19, 1861.

[7] [2,6] Bassani Fr.: "Preliminary communications on the fish fauna of the island Lesina" in: *Verhandlungen d. k. k. geol. R.-A.* 1879, p. 161–168, and "Descrizioni dei Pesci fossili di Lesina" in: *Denkschriften der Wiener Akademie, math.-naturw. Cl.*, v. 45, 1882, p. 195–288, Pl. I–XVI.

[8] [2,7] Societas hist.-nat. croatica, v. 1, p. 126; "Rad" jugosl. akademije, v. 72, p. 28, Zagreb 1884, and Glasnik hrvatskoga naravosl. društva, Godina I, 1886.

[9] [2,8] Kornhuber A.: "On a new fossil saurian from Lesina" in: *Verhandl. d. k. k. geol. R.-A.* 1873, v. 5, no. 4, p. 73–90, Pl. XXI–XXII.

[10] [2,9] Cornaglia et Chiozza: "Cenni geologici sull' Istria" in: Giornale dell' Istituto Lombardo de sc., lett. ed art. 1851, v. 3, Pl. I.

[11] [3,1] *loc. cit.*

[12] [3,2] See: *Aigialosaurus* in: Societas hist.-nat. croatica, [*Vol.*] 7 (reprint), Agram 1892, p. 8.

[13] [3,3] *Jahresbericht der k. k. geol. R.-A.* for 1890 in: *Verhandlungen* 1891, p. 13, and Stache G., The Liburnian level. *Abhandl[ungen] d. k. k. geol. R.-A.*, vol. 13, no. 1.

[14] [3,4] Stache, in the last-named place, p. 40.

[15] [3,5] *Abhandl[ungen] der. k. k. geol. R.-A.*, v. 5, no. 4, Vienna 1873.

[16] [4,1] *Denkschriften d[er] Wiener Akad[emie]*, v. 11, p. 188, note 2.

[17] [5,1] In its normal position the columella [=*epipterygoid*] abuts on the parietal and, directed downwards, sits on the pterygoid. Its morphological significance is uncertain. Calori, *loc. cit.* p. 178, saw it as the outer root of the proc[essus] pterygoideus (= pr[ocessus] tr[ansversalis] of the second cranial [sic.] vertebra). According to E. Gaupp ("Die Columella" etc., Anat[omischer] Anz[eiger], volume 6, 1891) it is homologous with the proc[essus] ascendens of the quadrate in salamanders.

[18] [5,2] In order to visualize clearly the positional relationships discussed in the text, think of laying Fig. 1 of Pl. III upon the head in Pl. I in such a way that the corresponding illustrated parts of the skull come into complementary contact.

[19] [5,3] Cf. Fr. Siebenrock: "The skeleton of *Lacerta Simonyi Steind.* etc.", in the *Sitz[ungs]b[erichte] d[er] k[aiserlichen] Akad[emie] d[er] Wiss[enschaft], math[ematisch]-naturw[issenschaftliche] Classe*, v. 103, part 1, p. 5, Vienna 1894, in which this question is discussed with characteristically exquisite clarity.

[20] [5,4] See: C. L. Nitzsch, "On the movement of the upper jaw of the lizard-like amphibians" in: Meckel's *Deutsch[es] Archiv für Physiologie*, v. 7, 1822.

[21] [7,1] As in our fossil, a true joint at the symphysis is also lacking in other Varanidae, and in Pythonomorpha, Ophidia, and in Ichthyosaurus, but not in Lacertilia generally, nor in Chelonia, Sauropterygia and Crocodilia.

[22] [8,1] *Ossemens fossiles*, 3rd ed., v. 5, part 2, Tab. 18 and 19. Cf. Owen, *Odontography*, v. 1, Pl. 72, Fig. 5 and text p. 258. London 1840–1845.

[23] [8,2] Cope, Edw[ard], *Transactions of [the] Americ[an] Philos[ophical] Soc[iety]*, P. I, p. 216.

[24] [8,3] Marsh, O. C., *Odontornithes. A monograph of the exstinct* [sic] *toothed birds of North-America.* New-Haven 1880.

[25] [8,4] *loc. cit.* page 217

[26] [8,5] *Cretaceous Reptiles of North-America*, Pl. XX, Fig. 3, and p. 50

[27] [8,6] *Bulletin of the U. S. geologic[al] and geograph[ical] Survey of [the] Territor[ies]*. 1878, vol. 4, p. 299–311
[28] [8,7] *Quartely* [sic] *Journal of [the] Geological Society*. London 1877, p. 682.
[29] [8,8] Cf. Cope, *Bulletin* etc. 1870, p. 303 and 304, and 1878, l. c.
[30] [9,1] C. Bergmann: "On dorsolumbar and lumbosacral transitional ribs" in: *Zeitschrift für rationelle Medicin*, Ser. 3, v. 14.
[31] [9,2] Fr. Siebenrock: The skeleton of *Lacerta Simonyi* etc. *Sitzber. d. k. Akad. d. Wiss.*, v. 103, Part I, p. 262-264.
[32] [9,3] *Ossemens fossiles*, v. 5, part 2, p. 284
[33] [9,4] *Accad. di Bologna* 1857, vol. 8, p. 163, and l. c. 1858, p. 346.
[34] [13,1] On Pl. I and II, which are produced at a somewhat smaller scale than the original, in particular at a ratio of 54:61, and so nearly 9:10, this length appears correspondingly smaller.
[35] [13,2] R. Owen: *On the Anatomy of Vertebrates. Vol. I. Fishes and Reptiles*. London 1866, p. 59.
[36] [13,3] C. Gegenbaur: *Grundzüge der vergleichenden Anatomie*. 2nd ed. Leipzig 1870, p. 610.
[37] [15,1] Because of an error in the illustration of the outline plate (II), one phalanx too many was represented in the fifth finger of the right hand, i.e., four instead of three.
[38] [17,1] Owen: On the Anatomy of Vertebrates, London 1866, [Vol.] I, pag[e] 190.
[39] [17,2] Gegenbaur C.: Untersuchungen zur vergl[eichenden] Anatomie der Wirbelthiere, [Vol.] I, 1864; and by the same author: Grundzüge der vergl[eichenden] Anatomie, Leipzig 1870, p. 699.
[40] [17,3] Hoffmann C. K.: Beiträge zur vergl[eichenden] Anatomie der Wirbelthiere. VI. Ueber den Tarsus bei den Sauriern [*Contributions to the Comparative Anatomy of the Vertebrates*, VI: *On the tarsus in the Sauria*]; in Niederländ[isches] Archiv für Zoologie, Vol. IV, 1877-1878; and in Bronn's Klassen und Ordnungen des Thierreiches [*Classes and Orders of the Animal Kingdom*], Vol. IV, 1884.
[41] [18,1] See Cope Ed[ward]: *Bulletin of the United States Geological and Geographical Survey of the Territories*, Vol. IV, No. 1, Washington 1878.
[42] [18,2] Cope Edw[ard], in *Proceedings of the American Philos[ophical] Society*, June 1869, and in *Transactions of the American Philos[ophical] Soc[iety]*, Vol. 14, Part 1, 1870.
[43] [18,3] The presence of a foramen parietale, as in our animal, likewise constitutes, according to Owen R. (*Palaeontology*, London 1861, p. 306), a characteristic feature of most Lacertilia.
[44] [19,1] See Kramberger, Dr. Carl Gorjanović-: "*Aigialosaurus*, a new lizard from the chalk layers of the island of Lesina," in the "*Rad*" *der südslavischen Akademie für Kunst und Wissenschaft in Agram*, Vol. 109, p. 96-123, *Tom.* I and II, translated in the transactions ["Schriften"] of the Societas historico-naturalis croatica of Agram, vol. 7, p. 74-106, reprint 1-33.
[45] [19,2] *loc. cit.* Agram (Zagreb) 1892.
[46] [20,1] cf. Brühl C. B.: *Zootomisch[er] Atlas*, 14th ed., Pl. 58, 54, Fig. 23 (in *Uromastix* [sic])
[47] [20,2] see Siebenrock Fr.: The skeleton of the Agamidae. *Wiener Akademie, Sitz[ungs]ber[ichte]*, vol. 104, part I. Nov. 1895, and Cope, Edw[ard] *loc. cit.* p. (1151) 93.
[48] [20,3] The name *"Ophiosauria"* is also entirely synonymous with and etymologically the same as *Pythonomorpha*, namely, snake-lizards = with the form of a snake (as a suborder of the scaled lizards)
[49] [20,4] *loc. cit.* p. (102) 29
[50] [20,5] The length of *Tylosaurus dispelor*, discovered in the Smoky Hills of Kansas a few years ago and which is now on exhibition in the American natural history museum of Washington, is supposed to measure as much as 270 feet, and including the missing caudal vertebrae 300 feet.
[51] [20,6] The shoulder girdle and the forelimbs were first proven by Ed[ward] Cope and described in *Proceed[ings of the] Boston Soc[iety]* in January 1869. In J[anuary] 1871 O. Marsh, in the *American Journal of Science and Arts*, p. 472, first described the pelvis of *Pythonomorpha* and noted the presence of hind-limbs. The latter simultaneously also addressed Ed[ward] Cope in a letter to J. P. Lesby in the *Proceedings of the American Philos[ophical] Society* 1871, p. 168.
[52] [20,7] The hypapophyses, which Edw[ard] D. Cope presents in *U[nited] St[ates] Geological Survey of the Territories*, Vol. II, 1875, cont[inued by?] *The Vertebrata of the cretaceous formations of the West*, Washington: Gouvernement [sic] printing office 1875 on Pl. 18, especially in Fig. 3b, 3c, 4a, 4b and others, haven't the remotest similarity to the structures joined to the cervical vertebrae, which Kramberger indicates for his *Aigialosaurus* and which, as was noted, have the impression of cervical ribs.
[53] Le sei vertebre cervicali distinguonsi perfettamente, come di solito, dalle dorsali per le spine o creste inferiori prodotte dalla parte posteriore delle faccie inferiori de'loro corpi, le quali creste portano nell' apice una epifisi; creste più lunghe nella seconda, terza e quarta vertebra, che nelle altre. Calori, "Sullo scheletro del *Monitor terrestris Aegypti* Cuv[ier]" in: *Memorie dell' Accademia di Bologna*, Vol. 8, 1857, p. 163. And also in *Lacerta ocellata* and *L. viridis*, *loc. cit.* 1858, p. 346.

[54] [20,9] In Bronn's *Klassen und Ordnungen des Thierreiches*, Vol. 6, Part 3. *Reptilien II. Eidechsen und Wasserechsen*. Leipzig 1900, p. 467.

[55] [21,1] Kornhuber, *Hydrosaurus lesinensis* in: *Abhandl. d. k. k. geol. R.-A.*, Vol. 5, No. 4, p. 81.

[56] [21,2] Brühl gives these the name transverse processes (parapophyses of Owen) in his "Table of osteological terms["], *Zootomisch[er] Atlas*, No. I.

[57] [20,3] Owen R.: *On Anatomy of Vertebrates*. Vol. I, p. 27, and Vol. II, Tab[le?] III, p. 587.

[58] [21,4] Siebenrock F.: "The skeleton of *Lacerta Simonyi* etc." *Wiener Akad[emie] Sitz[ungs]b[erichte]*, Vol. 103, Part I, p. 262.

[59] [21,5] *Rep[ort] of the U. S. Geol[ogical] Survey of the Territ[ories]* II, 1875, Pl. 37 of species of *Mosasaurus* in various positions and shapes; Cope Edw[ard], in *Transactions of the Americ[an] Philos[ophical] Soc[iety]* I, p. 187.

[60] [21,6] *Anatomie comparée*, 2nd ed., Vol. II, p. 528. Paris 1837.

[61] [21,7] Clason E.: "The morphology of the acoustic organ of lizards"; in: C. Hasse's *Anatomische Studien*, part 2, 1871, p. 309; likewise Siebenrock F.: "The skeleton of *Lacerta Simonyi*" *Wiener Ak. Sitz.-Ber. Math. Cl.*, Vol. 103, I, 1894, p. 25.

[62] [21,8] See the precise illustration in Parker W. K.: On the structure and development of the skull in the Lacertilia. I. On the skull of the common lizards, in: *Philos[ophical] Transactions of the royal Society of London*, Vol. 170, 1879, Pl. 42, Fig. 3, and Pl. 43, Fig. 3. Also Calori, Prof. Cav. Luigi, in: *Memorie dell' Accademia di Bologna* 1858, Vol. 9, Pl. 21, gives an exact figure from *Lacerta viridis*, and also his illustrations of *Stellio vulgaris*, same place, Vol. 10, Pl. 22, just like *Platydactylus muralis*, Vol. 9, Pl. 19, are reminiscent of the form of our fossil. Very conspicuously similar, as well, is the form in the Teju lizard, see Cuvier: *Oss. foss.*, 3rd ed., Pl. 16, Fig. 12., and more or less clearly also in many others (*Sauvegarde d'Amerique, Dragonne, Skink, Podinema Teguizin*....).

[63] [21,9] Cf. Blanchard E.: *Organisation du règne animal: Reptiles*, Pl. 14, Fig. 2 and 3, on *Platydactylus muralis*, and also Pl. 16, Fig. 1 and 3, on *Stellio vulgaris* and Pl. 30 on *Lacerta muralis*.

[64] [21,10] "On the reptilian ord[er] Pythonomorpha &c." *Proc[eedings of the] Boston Soc[iety of] Nat[ural] Hist[ory]*, January 1869, Vol. 12, p. 250; further, in *Trans[actions] of [the] Americ[an] Philos[ophical] Soc[iety]*, Vol. 14, Part I, 1870, p. 176; then in: *Rep[ort] of the U. S. Geol[ogical] Survey of the Territ[ories]*, Vol. II, 1875, p. 113, 114; and in: *Bulletin of the U. S. Geolog[ical] and Geogr[aphical] Survey of the Territ[ories]*, Vol. 4, No. 1 (1878), p. 305-308.

[65] [21,11] Cope Edw.: *Rep. U. S. geol. Surv. of Territ.*, 1875, Vol. II: *The Vertebrata of the cretaceous formations of the West*, p. 115.