

TWO NEW GENERA OF LATE PALEOZOIC CEPHALOPODS FROM CENTRAL ASIA.

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Dr. Hellmut de Terra, geologist of the recent German Central Asian Expedition,¹ obtained a small collection of cephalopods from one of the Late Paleozoic formations north of the Karakoram Mountains, northern Kashmir, that he kindly submitted to the writer for study. This collection consists of only three recognizable specimens, but all of them, though fragmentary and only moderately well preserved, are of such nature that most of their generic characters can be ascertained and their age can be determined within reasonable limits. Since these fossils came from a remote and difficultly accessible place, they are naturally interesting, but their intrinsic value is due to the fact that two of them represent previously unrecognized genera.

The cephalopods were collected from grayish green calcareous shales near Woabjilga, in the so-called Aghil-Depsang or Central Ranges, i.e., the ranges north of the Karakoram and south of the K'un-lun mountains. Two of them are ammonoids, whereas the third is a nautiloid. The latter represents a previously unrecognized genus, members of which occur also in the Upper Pennsylvanian (Cisco and Douglas) of Texas and Nebraska. One of the ammonoids is described below as the type of a new genus whose affinities are with the Glyphioceratidae, which are widespread and abundant in the Late Paleozoic; the second ammonoid appears to represent the genus *Schistoceras*, which is so characteristic of the uppermost Pennsylvanian of the United States that the horizon is often referred to as the "Zone of *Schistoceras*." The available evidence therefore indicates that the strata from which these fossils came are of Upper Pennsylvanian age and are to be correlated with the Cisco and equivalent formations of North America.

As far as the writer has been able to learn, strata of the age of the "Zone of *Schistoceras*" are of relatively limited distribution but are known to occur in central Germany (Wettiner

¹See his preliminary publications in: Geol. Rundschau, 19 and 20; 1928-29; Zeitschrift f. Geomorphologie, 5, 1930; this Journal, 21, 1931; and a popular account in The National Geographic Magazine, 59, 1931. The geological data secured are to be summarized in one volume, which is now nearing completion.

beds) as well as in Texas, Illinois, Missouri, and Ohio. Suess,² basing his statements on fossils collected by Ferdinand Stoliczka and studied by Mojsisovics, reported the presence of Permian strata north of the Karakoram Pass at the same locality at which de Terra obtained the cephalopods described below. The fossils came from a red marble and were identified by Mojsisovics as *Xenodiscus* cf. *X. peregrinus* Beyr. and *X. carbonarius* Waag., *Gastrioceras abichianum* Moeller?, *Orthoceras* sp., and *Nautilus* cf. *N. convolutus* Waag. Neither descriptions nor illustrations of these fossils have ever been published, and an attempt to locate and borrow them was unsuccessful. It was at first supposed that the fauna obtained by de Terra was of the same age as that described by Suess, and such may possibly be the case. The only fossil obtained which militates strongly against such an interpretation is the single fragment described below as *Schistoceras* sp., and it must be admitted that that specimen is so incomplete and poorly preserved as to make positive identification of it impossible. The sutures present certain similarities to those of *Agathiceras* and *Adrianites* of the Permian, but the lobes are long and pointed and more or less hastate, rather than short and spatulate, and there is no trace of spiral lirae which are so strongly developed in *Agathiceras*. These facts have led the writer to the conclusion that the specimen in question should be referred to the genus *Schistoceras*. This genus has not been recognized previously outside of central United States where it is abundantly represented in the Upper Pennsylvanian (Zone of *Schistoceras*) but is known to occur also in the Zone of *Uddenites* which is regarded by the writer as the base of the Permian but by some authors as the top of the Pennsylvanian. Since the single nautiloid obtained by Dr. de Terra from the same horizon represents a genus which at present is known to occur only in the Upper Pennsylvanian of Texas and Nebraska, it seems that the available evidence, though rather meager, clearly indicates that the fauna under consideration is of Upper Pennsylvanian age and is distinctly older than that studied by Mojsisovics from the same region.

Pennsylvanian strata are known to be widespread in Central Asia and outcrops of them have been reported from the Tekelik-tag and Jatantshi-tag ranges of the K'un-lun Mountains and the Pamir Highlands, as well as the Central Ranges

² Suess, Eduard, Beiträge zur Stratigraphie Central-Asiens : Denkschriften d. kais. Akad. d. Wiss., math.-naturw. Classe, 41, 29-30, 1894.

between the Karakoram and the K'un-lun mountains. However, no ammonoids have been found in any of them that are at all comparable to those obtained by Dr. de Terra and described below.

DESCRIPTION OF GENERA AND SPECIES.

Genus *Dolorthoceras*, n. gen.

As mentioned above the single nautiloid obtained by Dr. de Terra appears to represent a previously unrecognized genus, and the generic name *Dolorthoceras* is here proposed for it. *Dolorthoceras circulare*, n. sp., is the genotype, and the following generic diagnosis is based largely on it, but several specimens representing two undescribed species from the Upper Pennsylvanian (Cisco and Douglas) of Texas and Nebraska are available for comparisons.

Conch long, narrow, straight, gradually and regularly expanded orad, and circular to broadly elliptical in cross section, being more or less depressed dorso-ventrally. Test relatively thin and devoid of ornamentation other than transverse growth-lines. Septa simple saucer-shaped disks moderately convex apicad. Sutures straight and directly transverse to long axis of conch. Siphuncle intermediate in position, i.e., neither marginal nor central; small at its passage through the septa but expanded within the camerae; and cyrtochoanitic in structure. Septal necks very short but strongly recurved. Segments of siphuncle subcylindrical in shape but contracted abruptly at the passage of the siphuncle through the septa. The connecting rings are not in contact with the adjacent septa outside of the septal necks.

The very short, strongly recurved septal necks and the subcylindrical siphuncular segments are the most distinctive characters of this genus. They serve to distinguish it from all other similar genera with the possible exception of *Euorthoceras* Foerste.³ No diagnosis of that genus (or subgenus) has ever been published, and in the original publication of the generic name no forms are referred to it that are not *species inquirendae*. This latter fact makes it virtually impossible to select a genotype in accordance with the International Rules of

³ Foerste, Aug. F., Notes on Clinton group fossils, with special reference to collections from Indiana, Tennessee and Georgia: Boston Soc. Nat. Hist. Proc., 24, 278-281, 1889; and Fossils from the Clinton group in Ohio and Indiana: Ohio Geol. Survey Report, 7, 539-543, 1893.

Zoological Nomenclature, and until such is established, adequate comparisons are not possible. However, since all of the forms that have been referred to that genus are of Silurian age, it is not probable that any are congeneric with the Pennsylvanian forms on which the above proposed genus is based.

Dolorthoceras circulare, n. sp.

(Figs. 1, 2.)

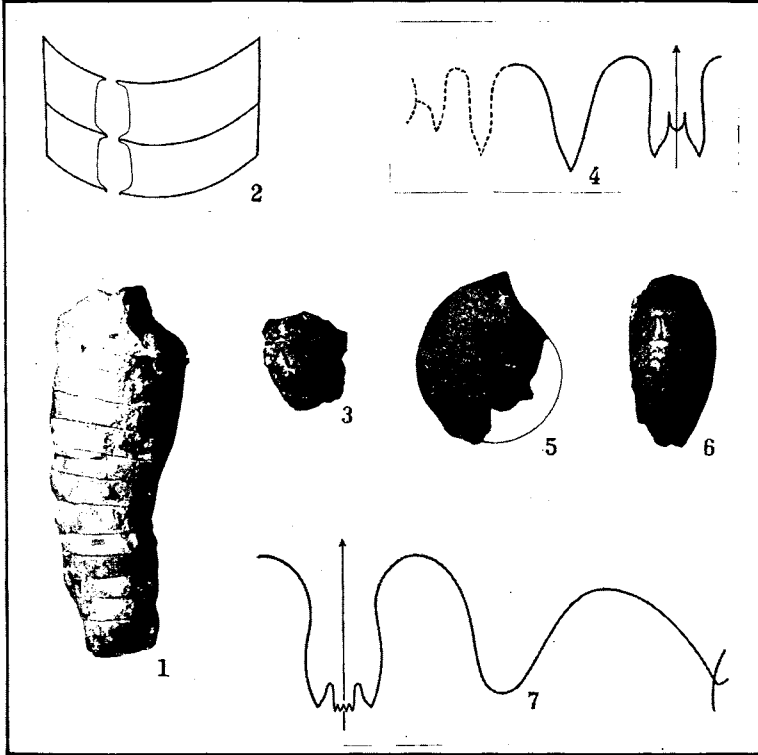
Conch long, narrow, straight, gradually and regularly expanded orad, and circular (or nearly so) in cross section. Holotype, an internal mold of part of phragmacone, is about 45 mm. long and its diameter increases from about 10 mm. at its adapical end to about 18 mm. at its adoral, indicating an apical angle of approximately 5 degrees. None of the test remains, but the internal mold, at least, is smooth and entirely devoid of ornamentation other than the sutures.

Septa simple saucer-shaped disks moderately convex apicad; their curvature is equal to about one-fifth their diameter. Sutures simple circles directly transverse to long axis of conch; five of them occur in a length equal to the diameter of the phragmacone. The camerae in the extreme adoral part of the holotype are slightly shorter than the preceding ones, indicating that the specimen represents a mature individual.

Siphuncle intermediate in position, small at its passage through the septa, but expanded within the camerae. Septal necks very short and strongly recurved. Segments of siphuncle subcylindrical in shape but slightly wider in adapical part of camerae than in adoral and abruptly contracted at the passage of the siphuncle through the septa; they are much more abruptly contracted adorally than adapically. The connecting rings are not in contact with the septa outside of the septal necks. Where the diameter of the phragmacone measures about 16 mm., the center of the siphuncle is about 3 mm. from the ventral wall of the conch, the siphuncle measures about 1 mm. in diameter at its passage through a septum but attains a maximum diameter of approximately $2\frac{1}{2}$ mm. within the adjacent camera, and the septal necks are less than $\frac{1}{2}$ mm. long.

Remarks.—The above description is based on a single moderately well-preserved internal mold which has been somewhat distorted during preservation. It represents only part

of the phragmacone and nothing is known in regard to the living chamber or the adapical part of the conch. It differs



Figs. 1, 2. *Dolorthoceras circulare*, n. gen. and sp. Lateral view of holotype, x1, and diagrammatic longitudinal section of two of the adoral camerae showing the nature of the siphuncle, x2. The irregular curvature of the specimen is believed to be due to distortion during preservation.

Figs. 3, 4. *Schistoceras* sp. Ventral view, x1, and diagrammatic representation of a suture, x4.

Figs. 5-7. *Karakoramoceras stoliczkaei*, n. gen. and sp. Lateral and ventral views of holotype, x1, and diagrammatic representation of a suture, x4.

All specimens figured are from Upper Pennsylvanian shales near Woabjilga, in the Central Ranges between the Karakoram and the K'un-lun mountains of Central Asia.

from the North American representatives of this genus in that its conch is circular (or nearly so) in cross section, its siphuncle is somewhat nearer the margin of the conch, and its

siphuncular segments are not precisely similar in shape as their sides are not quite parallel and they are less abruptly contracted at their adapical ends.

Occurrence.—Grayish green calcareous shales of Upper Pennsylvanian age, near Woabjilga, Central Ranges; in association with *Schistoceras* sp. and *Karakoramoceras stoliczkai*.

Holotype.—Geologisch-Paläontologisches Museum der Universität Berlin.

Genus *Karakoramoceras*, n. gen.

This genus is based on a single internal mold, which, though incomplete and only moderately well preserved, suffices to indicate the general form of the conch, the nature of the umbilicus, and the shape of the external sutures. The conch is subdiscoidal as the whorls are slightly depressed, flattened laterally, narrowly rounded ventrally, and deeply impressed dorsally. The umbilicus is small, the umbilical shoulders are abruptly rounded, and the umbilical walls appear to be approximately perpendicular to the flat lateral sides of the conch. The external suture consists of a moderately narrow, almost straight-sided ventral lobe and on either side of it a slightly broader rounded U-shaped external saddle, a shorter broad narrowly rounded lateral lobe, a broad rounded lateral saddle, and a short subangular lobe on the umbilical shoulder. The nature of the ventral lobe is the most distinctive character of the genus. It is slightly contracted near mid-height and is unequally trifid; the two lateral subdivisions are moderately small and are obtusely pointed; the central one is slightly broader and longer and is quadrifid. The secondary saddles are narrowly rounded but the tertiary ones, like the intervening lobes, are angular.

The general form of the conch, the narrow umbilicus, and the shape of the sutures of this form suggest a relationship to such Mississippian genera as *Aganides* (*Imitoceras*) and *Münsteroceras*. The narrowness of the ventral lobe seems to exclude an otherwise plausible close relationship to *Dimorphoceras* and *Prothalassoceras* and to indicate that *Karakoramoceras* developed out of one of the glyphioceran stocks by the enlargement and later the serration of the small tertiary median ventral lobe that is so common in the Glyphioceratidae. A comparable serration is known to occur in the secondary ventral saddle of some of the other members of that family.

viz., representatives of *Paralegoceras* and *Gastrioceras* of the Permian of Timor.

Karakoramoceras stoliczkai, n. sp.

(Figs. 5-7.)

Conch subdiscoidal as whorls are slightly depressed, flattened laterally, narrowly rounded ventrally, and deeply impressed dorsally. Maximum diameter attained by preserved part of conch of holotype, which is septate throughout and therefore represents only part of phragmacone, about 24 mm.; maximum width, which is attained just ventrad of umbilical shoulders, about 12 mm. Height of whorl only slightly less than maximum width, and whorls appear to be impressed dorsally by preceding volution to more than half their height.

Umbilicus small and deep; umbilical shoulders abruptly rounded; and umbilical walls steep and approximately perpendicular to flat lateral sides. Diameter of umbilicus equal to about one-eighth that of specimen; maximum diameter of umbilicus of holotype, about 3 mm.

Internal mold, at least, smooth and entirely devoid of markings other than sutures. External suture consists of a moderately narrow, almost straight-sided ventral lobe and on either side of it a slightly broader rounded U-shaped external saddle, a shorter broad narrowly rounded lateral lobe, a broad rounded asymmetrical lateral saddle, and a short subangular lobe on the umbilical shoulder. The ventral lobe is slightly but very distinctly contracted near mid-height, and it is unequally trifid; the two lateral subdivisions are moderately small and are obtusely pointed; the central one is slightly broader and longer and is quadrifid. The secondary saddles are narrowly rounded but the tertiary ones, like the intervening lobes, are angular.

The specific name is given in honor of Dr. Ferdinand Stoliczka, whose excellent pioneer work in Central Asia forms the basis of much of our knowledge of the stratigraphy there.

Remarks.—The above description is based on a single mediocre internal mold which represents only part of the phragmacone. The external sutures are fairly well preserved and are clearly discernible, but the internal ones are not visible. The shape of the external sutures alone is sufficient to distinguish this form from all previously described species.

Occurrence.—Grayish green calcareous shales of Upper Pennsylvanian age, near Woabjilga, Central Ranges; in association with *Dolorthoceras circulare* and *Schistoceras* sp.

Holotype.—Geologisch-Paläontologisches Museum der Universität Berlin.

Schistoceras sp.

(Figs. 3, 4.)

Form subglobose; conch expanded orad fairly rapidly; whorls depressed dorso-ventrally, rounded ventrally, only slightly flattened laterally, impressed dorsally, and helmet-shaped in cross section. Height of whorl equal to about seven-elevenths maximum width, which apparently is attained just ventrad of umbilical shoulders; whorls are impressed dorsally to about one-third their height by preceding volution. Nature of umbilical shoulders and umbilicus not ascertainable.

Internal mold smooth and no trace of markings other than sutures discernible. The external suture consists of a moderately short, broad ventral lobe, which is divided by a prominent median saddle, and on either side of it at least four saddles and three lobes; only part of the fourth saddle is discernible, and it probably was located on the umbilical shoulder. The medial saddle of the ventral lobe is moderately short and blunt, and it is centrally notched; it is about two-fifths as long as the ventral lobe. Each of the branches of the ventral lobe is distinctly narrower than the median saddle and both are asymmetrically pointed. The external saddle is slightly broader than the ventral lobe; it is straight-sided and is asymmetrically U-shaped. The first lateral lobe is distinctly longer than the ventral; its sides are essentially straight and it is sharply pointed and is therefore V-shaped. The first lateral saddle is similar to the external saddle, but it apparently is slightly shorter and its asymmetry is reversed. The rest of the suture is not well preserved and its exact shape can not be made out with certainty. The second lateral lobe appears to be long, narrow, and pointed, but distinctly shorter than the first lateral lobe. The second lateral saddle also appears to be relatively long and narrow, but it is rounded. Only the ventral part of the third lateral lobe is discernible, but that lobe appears to have been shorter than the preceding one, pointed, and asymmetrical. The rest of the external suture and the internal suture are not visible.

Remarks.—The above description is based on a single small specimen which is an internal mold representing only a small

portion of three whorls of the phragmacone. It is rather poorly preserved, but the ventral and first lateral lobes of the sutures are very distinct and two other lateral lobes are discernible but their exact shape is somewhat doubtful. The general form of the conch and the shape of the sutures indicates a relationship to *Schistoceras* Hyatt, to which the specimen is accordingly referred. It should be emphasized, however, that the specimen represents such a small part of the conch and is so poorly preserved that its reference to any genus must be regarded as tentative. The median saddle in the ventral lobe is somewhat shorter than that of any of the previously described representatives of *Schistoceras*, but this difference would appear to be of specific rather than generic significance. The sutures present certain similarities to those of *Agathiceras* and *Adrianites*, but the lobes are long and pointed and more or less hastate rather than short and spatulate, and there is no trace of spiral lines, which are so well developed in *Agathiceras*.

The genus *Schistoceras* was established as early as 1883, but its type species was undescribed and it was therefore little understood before the appearance of J. P. Smith's well-known monograph of the Carboniferous ammonoids of America in 1903. Since that time several new representatives have been described, but all came from North America and the genus has not been recognized previously outside of the Upper Pennsylvanian and lowermost Permian (Zone of *Uddenites*) of central United States, i.e., Texas, Illinois, Missouri and Ohio, although strata of equivalent age are known to occur in central Germany (Wettiner beds). In view of this fact, the writer is rather hesitant about referring a fragmentary and poorly preserved specimen from such a distant region to the genus, but if, as is now believed, the identification is correct, the age of the containing strata is in all probability Upper Pennsylvanian and the "Zone of *Schistoceras*" is much more widespread geographically than has hitherto been believed.

Occurrence.—Grayish green calcareous shales of Upper Pennsylvanian age, near Woabjilga, Central Ranges; in association with *Dolorthoceras circulare* and *Karakoramoceras stoliczkai*.

Figured specimen.—Geologisch-Paläontologisches Museum der Universität Berlin.