Caracoliceras, a new Oxfordian (Upper Jurassic) ammonite genus from northern Chile

Axel von HILLEBRANDT1, Annette KOSSLER2 & Manfred GRÖSCHKE1

Abstract
A new Oxfordian ammonite genus of the ?Perisphinctidae, Caracoliceras n. gen., is described from northern Chile. Four taxa could be recognized within the new genus: Caracoliceras dunkeri, C. cf. dunkeri, C. sp. A, and C. sp. B. The stratigraphic distribution of these endemic ammonites is restricted to the Lower Oxfordian and the ?lowermost Middle Oxfordian. In this time period, the new genus was a dominant faunal component of the Chilean ammonite assemblages. It is very likely that the new genus evolved from the youngest Andean reineckeids.

Key Words
Jurassic, Oxfordian, Ammonoidea, Perisphinctidae, South America, Chile.

INTRODUCTION
Since the last century, few efforts have been made to study ammonites from Early Oxfordian strata of northern Chile (eg. STEINMANN, 1881; STEHN, 1923; BIESE, 1957; HILLEBRANDT & GRÖSCHKE, 1995). The present study benefits from this research and, additionally, from new materials collected by members of the Research Group «Mobilität aktiver Kontinentalränder» and the Special Research Project 267 «Deformationsprozesse in den Anden» of the German Research Foundation during the last decades.

Early Oxfordian ammonite assemblages from several localities in northern Chile are mainly composed by endemic taxa. Following detailed investigations of these ammonites, this article aims at introducing the new genus Caracoliceras. The majority of the recognized species belongs to this new genus.

In northern Chile, «Cosmoceras dunkeri» was also recorded from the Late Callovian of Cerritos Bayos by BIESE (1957: p. 454). In addition, BIESE (1956: p. 892) described a «Cosmoceratiden-Bank» from the Coastal Cordillera east of Iquique, which he placed in the Bathonian.


From this point on, these ammonites were determined as «Perisphinctes» dunkeri. The occurrence of «Perisphinctes» dunkeri is now well-documented from various out-crops of the Lower Oxfordian in northern Chile (GROSCHKE & HILLEBRANDT, 1985; GYGI & HILLEBRANDT, 1991; HILLEBRANDT & GRÖSCHKE, 1995; KOSSLER, 1998; GRÖSCHKE & KOSSLER, 1999; WITTMANN, pers. com.). Furthermore, HILLEBRANDT identified some unlabeled specimens among the BIESE Collection (National Museum of Natural History, Washington) as «Perisphinctes» dunkeri (comp. BIESE, 1957).

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FOSSIL LOCALITIES AND BIOSTRATIGRAPHY

1. Coastal Cordillera (Tarapacá region)

a. Quebrada Los Tarros (SE of Arica)
Marine Upper Jurassic strata of Early to Late Oxfordian age crop out in the Quebrada Los Tarros area. In the lowermost ammonite-bearing horizon a fragment of the new genus *Caracoliceras sp. A* was collected by Dipl. Geol. Sonja WITTMANN (TU-Berlin). The upper part of the section is biostratigraphically well documented by ammonites of the Transversarium Zone (GYGI & HILLEBRANDT, 1991).

b. Cerro Huantajaya area (E of Iquique)
Fragments of *«Perisphinctes» dunkeri (= *Caracoliceras* cf. dunkeri, *C. sp. A*) were described by KOSSLER (1998: p. 121, tabl. 13, fig. 2-6) from two localities in the area of the Cerro Huantajaya, approximately 10 km east of Iquique. In this area, the lower part of the Oxfordian succession is characterized by a thick, monotonous series of thin-bedded calcilutites containing only one ammonite-bearing horizon (KOSSLER 1998: section No. 18 «AT 9»; fossil locality No. 10 «1037er»). The ammonite assemblage, which is found in this horizon, consists of *«Perisphinctes» dunkeri, Campylites (Neoprionoceras) sp.*, and *«Perisphinctes» sp.* Further up, the lower part of the Oxfordian succession is overlain with a tectonic unconformity by Middle Oxfordian sediments, which contain ammonites of the Transversarium Zone.

In all probability, the ammonites from the Coastal Cordillera east of Iquique, which are described as *Virgatosphinctes* of the Early Tithonian by CECIONI (1961: p. 6) and as *Progeronia* of the Early Kimmeridgian by THOMAS (1970: p. 26, section No. 9 = section No. 18 «AT 9» in KOSSLER, 1998), are misidentified specimens of the new genus. SALAS et al. (1966) also mentioned Lower Kimmeridgian deposits from the Quebrada Los Tarros area based on the occurrence of *Progeronia*. Both *Virgatosphinctes* and *Progeronia* show a type of ribbing similar to the new genus which explains these misinterpretations and the wrong biostratigraphical classification. However, there is no evidence for Jurassic sediments younger than Oxfordian age in the northern part of the Chilean Coastal Cordillera (KOSSLER, 1998; WITTMANN, pers. com.).

2. Precordillera (Antofagasta region)

a. Cerro Jaspe (E of Sierra Moreno)
GRÖSCHKE & KOSSLER (1999) described an Early Oxfordian ammonite assemblage from an isolated, small out-crop located approximately 10 km NW of the Cerro Jaspe. The ammonite assemblage consists of *Jaspeiceras philippii, Jaspeiceras ex gr. covacevichi, Reineckeia sp. A*, and *«Perisphinctes» ex gr. dunkeri (= *Caracoliceras* sp. A)*.

Fig. 1: Sketch map of northern Chile showing fossil localities from the Coastal Cordillera (1 a-b) and the Precordillera (2 a-j).
b. Cerritos Bayos
The specimens of *Caracoliceras dunkeri* among the BIESE collection (National Museum of Natural History, Washington) were derived from the Cerritos Bayos area. Two localities are given on the label of the specimens, «E of Cerro Amarillo» and «Quebrada Oriental», however, the exact position of the sections is unknown. BIESE (1957: p. 454) mentioned the occurrence of *Cosmoceras dunkeri* together with ammonites of the Callovian and the Oxfordian. According to GYGI & HILLEBRANDT (1991) and HILLEBRANDT & GROSCHKE (1995: p. 13), the relative stratigraphic position of the «Perisphinctes» *dunkeri* horizon is restricted to a time period between horizons of the lowermost Early Oxfordian and the Middle Oxfordian age.

c. Caracoles
The area of Caracoles is characterized by a great number of Middle to Upper Jurassic sections. STEINMANN (1881: p. 272, pl. 12, fig. 9) described the type species of the new genus *Cosmoceras Dunkeri* (= *Caracoliceras dunkeri*) from Caracoles; however, the exact location and the type horizon are unknown. Although, since then, several studies about the Middle to Upper Jurassic succession have been conducted (LEANZA, 1947; GYGI & HILLEBRANDT, 1991; RICCARDI & WESTERMANN, 1991; HILLEBRANDT & GROSCHKE, 1995), the *dunkeri*-bearing horizon between the lowermost Lower and the Middle Oxfordian strata could still not be recovered up to this day.

d. Quebrada San Pedro
Several Jurassic out-crops (Bajocian to Kimmeridgian) exist in the area of the Quebrada San Pedro. The Jurassic succession is partly folded and tectonically disturbed. An Oxfordian section of this region is described in GYGI & HILLEBRANDT (1991: fig. 2). The only ammonites found at the base of this section belong to the «Perisphinctes» *dunkeri* group (= *Caracoliceras cf. dunkeri*). The succeeding ammonite assemblage consists of diverse species of «Perisphinctes» s.l. Further up, the Transversarium Zone of the Middle Oxfordian is well-documented by the zonal index species *Gregoryceras transversarium* (QUENSTEDT). The section ceased with sediments of the Bifurcatus Zone.

e. Cerro Amarillo
The Callovian to Oxfordian section of the Cerro Amarillo area is well-documented by GRÖSCHKE & HILLEBRANDT (1985: fig. 3a, 4), GYGI & HILLEBRANDT (1991: fig. 3, 4), and HILLEBRANDT & GROSCHKE (1995: fig. 2). The Oxfordian part of the section starts with peltoceratids of the Dimorphosus Zone of the lowermost Oxfordian, which is succeeded by a horizon containing ammonites of the «Perisphinctes» *dunkeri* group (= *Caracoliceras* sp. A and C. sp. B); ammonite assemblage 4 in HILLEBRANDT & GROSCHKE, 1995). The upper part of the section is characterized by an ammonite assemblage of the Transversarium Zone of the Middle Oxfordian. HILLEBRANDT & GROSCHKE (1995) proposed this section as type locality for the Dunkeri Zone.

f. Cerro Augusta Victoria
An anticline, which is mainly composed of Oxfordian sediments, is located approximately 7 km NW of the Cerro Augusta Victoria, quite close to Point 1675. This Oxfordian sequence is well-documented by GRÖSCHKE & HILLEBRANDT (1985: fig. 3d, loc. 5, 7), and HILLEBRANDT & GROSCHKE (1995: p. 8). The lowermost ammonite horizon contains peltoceratids, which have been reported from around the Callovian/Oxfordian boundary HILLEBRANDT & GROSCHKE (1995: p. 12). Further up, two beds in quick succession bear densely ribbed fragments of the new genus (*Caracoliceras* sp. A), and *Perisphinctes* s.l. The upper part of this section is characterized by sediments, which contain ammonites of the Transversarium Zone.

g. Aguada El Oro
The Callovian to Oxfordian sequence of the Aguada El Oro area is described by HILLEBRANDT & GROSCHKE (1995: p. 9, fig. 2). The Oxfordian is characterized by few ammonite-bearing horizons. From today's perspective, above an ammonite assemblage from around the Callovian/Oxfordian boundary (HILLEBRANDT & GROSCHKE, 1995: fig. 2, horizon 3) occurs prior *Perisphinctes* s.l. (HILLEBRANDT & GROSCHKE, 1995: fig. 2, horizon 4), which itself is followed by a *Perisphinctes/Euaspideroceras* assemblage (HILLEBRANDT & GROSCHKE, 1995: fig. 2, horizon 5). The *Perisphinctes/Euaspideroceras* assemblage probably belongs to the Eugenii Zone (= Cordatum Zone) of the lower Oxfordian, based on the occurrence of *Euaspideroceras* ex gr. *E. freii* (JEANNET). Specimens of *Perisphinctes dunkeri* (= *Caracoliceras dunkeri*) were found in the overlying ammonite-bearing stratum (HILLEBRANDT & GROSCHKE, 1995: fig. 2, horizon 6). The uppermost ammonite-bearing horizon contains *Gregoryceras cf. chongi* GYGI & HILLEBRANDT of the Transversarium Zone (HILLEBRANDT & GROSCHKE, 1995: fig. 2, horizon 7).

h. Aguada El Minero
An Oxfordian section located north of the Quebrada Aguada del Minero («Profeta Jurassic») is described by GYGI & HILLEBRANDT (1991: p. 142, fig. 5, 6). A «Perisphinctes» *dunkeri* (= *Caracoliceras dunkeri*)-bearing stratum is proven between horizons with reineckeids from around the Callovian/Oxfordian boundary, and with perispinctids and peltoceratids of the Transversarium Zone.
i. Agua del Carretón
The Oxfordian sequence of the Agua del Carretón area is described by GYGI & HILLEBRANDT (1991: fig. 9, 11), and HILLEBRANDT & GRÖSCHKE (1995: fig. 2). The lowermost ammonite horizon belongs to the Primus Zone of the uppermost Callovian. The second ammonite-bearing horizon, 120 m above the lowermost one, contains specimens of «Perisphinctes» dunkeri (Caracoliceras dunkeri). A third ammonite horizon, 80 m above the dunkeri-bearing stratum, bears an ammonite assemblage of the Bifurcatus Zone.

j. Quebrada del Oreganito
The area, which extends from the Quebrada Incaguasi to the Quebrada Agua de la Piedra (see Fig. 2), is characterized by several Jurassic out-crops with folded and in part tectonically disturbed marine sediments of Lower Sinemurian to Middle Oxfordian age (e.g. HILLEBRANDT, 1977, 1981, 1987). In general, the Jurassic strata dip to the west, therefore, out-crops of the Oxfordian are confined to the western part of the area. A Caracoliceras dunkeri-bearing horizon occurs in an anticline, which is composed of Oxfordian strata. It is located in the Quebrada del Oreganito, approximately 2 km west of Cerro Agua de la Piedra and 5,4 km north of Point 3273 (see Fig. 2). Above the dunkeri horizon, the next biostratigraphically determined horizon, which contains Perisphinctes (Antiloceras) prophetae GYGI & HILLEBRANDT, P. koeneni STEINMANN, P. indogermanus WAGEN, and Euaspidoceras sp., belongs to the Transversarium Zone. It is separated from the dunkeri-bearing horizon by approximately 90 m of calcilutites.

STRATIGRAPHIC DISTRIBUTION OF THE DUNKERI ZONE
Due to the lack of guide fossils, the rather poor ammonite fauna, and the distinct endemism of the Chilean ammonite fauna of the Early Oxfordian, the relations between the Chilean strata and the European Standard Zones of the Oxfordian were not fully understood for a long time. However, some detailed investigations of Early to Middle Oxfordian ammonite assemblages were conducted during the last few years. These studies now allow for a closer correlation of these Chilean layers with the European Standard Zones (GYGI & HILLEBRANDT, 1991; HILLEBRANDT & GRÖSCHKE, 1995; GRÖSCHKE & KOSSLER 1999).

In current research, the ammonites of the dunkeri-group are considered to have been restricted to the Chilean faunal realm. Therefore, HILLEBRANDT & GRÖSCHKE (1995) proposed to establish the Dunkeri Zone for the north Chilean region and chose the Oxfordian section of the Cerro Amarillo area as type section for this Zone. In the period of the proposed Dunkeri Zone, the Chilean ammonite fauna was predominantly composed of these endemic ammonites. It is noteworthy that no well-known guide fossils occurred. The stratigraphic distribution of the Dunkeri Zone seems to be limited by the underlying Eugenii Zone of the Lower Oxfordian and the overlying Transversarium Zone of the lower Middle Oxfordian (see Table 1). In northern Chile, the Eugenii Zone is proven by the zonal index species Peltomorphites eugenii (RASPIAL) (HILLEBRANDT & GRÖSCHKE, 1995: p. 13), which is well-known from different Lower Oxfordian strata of the world (e.g. JEANNET, 1951; COLLIGNON, 1959; MATYJA, 1977; GYGI & MARCHAND, 1982; PAGE in MARTILL & HUDSON, 1991). COLLIGNON (1959) erected the Eugenii Zone, based on the common occurrence of Peltomorphites eugenii in Madagascar. The Eugenii Zone is in part comparable with the European Cordatum Zone of the Lower Oxfordian. The beginning of the Transversarium Zone is proven by Gregoryceras chongi and Perisphinctes (Antiloceras) prophetae of the Antecedens Subzone (GYGI & HILLEBRANDT, 1991) which, according to GYGI'S opinion, belongs to the Transversarium Zone, not to the Plicatilis Zone (see Tabl. 1).
Table 1: According to CALLOMON et al. (1987) and HILLEBRANDT & GRÖSCHKE (1995), correlation of the European Standard Zones of Late Callovian to Middle Oxfordian age with the proposed Chilean Zones.

<table>
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<td>Late</td>
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Nevertheless, due to the scarce ammonite bearing-horizons within the sections and without knowledge of the exact zonal boundaries, the stratigraphic distribution of the Dunkeri Zone can only be assumed.

SYSTEMATIC DESCRIPTION

Repository of material: The material used in this study are stored in the TU-Berlin (Hi-No., Gr-No., Ko-No., Wi-No.), in the University Marburg (Mbg. 1828), in the Naturkundemuseum Basel (JMB J 31200), and in the National Museum of Natural History, Washington (USNM 508949, 508950).

Abbreviations: d, diameter in mm; p, primary ribs on a whole whorl; p/2 primary on a half whorl; s, ventral ribs; h, whorl height as a % of diameter; w, whorl width as a % of diameter; u, umbilical width as a % of diameter; h/w, whorl height/whorl width ratio.

Suborder Ammonitina HYATT, 1889
Superfamily Perispinctaceae STEINMANN, 1890
? Family Perispinctidae STEINMANN, 1890

Genus Caracoliceras nov. gen.
Type species: Cosmoceras dunkeri STEINMANN (1881: p. 272; pl. 12, fig. 9), holotypy by monotypy.

Derivation of the name: Named after Caracoles, northern Chile, the type locality of Cosmoceras dunkeri.

Diagnosis: Moderately evolute to evolute. Whorl section variable: depressed-subrounded to subsquarish. Umbilicus with rounded umbilical angle, umbilical wall sometimes slightly undercut. Ornamentation Perispinctes-like; ribbing more or less reverse sinuous and irregular with simple, bi-, triplicate, and polygyrate ribs. Constrictions irregular and scarce. Suture lines relatively simple perispinctid with retracted suspensive lobe.

Remarks: The new genus Caracoliceras, previously attributed to «Perispinctes», significantly differs from the perispinctids s.s. in its more depressed whorl section at comparable growth stages. We assumed that Caracoliceras is derived from the genus Jaspeiceras GRÖSCHKE & KOSSLER, which belongs to the youngest reineckeids from around the Callovian/Oxfordian boundary (GRÖSCHKE & KOSSLER, 1999). Densely ribbed fragments of Caracoliceras co-occur with the last representatives of Jaspeiceras in Lower Oxfordian strata. In addition, the suture line of Jaspeiceras falls within the range of variation attributed to the new genus. However, Caracoliceras differs from Jaspeiceras, which also has a similar cross-section, coiling-mode, and type of ribbing, in the lack of tubercles and the weakly pronounced or absent interruption of ribs on the venter. Nevertheless, according to ARKELL et al. (1957), Caracoliceras is grouped into the family of the Perispinctidae on account of the perispinctoid ribbing without recognisable tubercles. However, there remain some doubts about the classification, due to the assumed derivation from the reineckeids and the character of the whorl section, which is rather different from other Callovian/Oxfordian perispinctids.

Temporal range: Dunkeri Zone (Lower Oxfordian - Middle Oxfordian).

Caracoliceras dunkeri (STEINMANN, 1881)
Pl. I, figs. 1-5; Pl. II, figs. 1-5; Pl. III, fig. 1; Fig. 3 A-E; Fig. 4 A-C; Fig. 5 A-D, F

1881. Cosmoceras dunkeri STEINMANN, p. 272; pl. 12, fig. 9.

Holotype: Original of STEINMANN, 1881, pl. 12, fig. 9, Uni Marburg: Mbg. 1828.
Fig. 3: Types of ribbing of:
A-E = *Caracoliceras dunkeri* (STEINMANN): A, Caracoles (holotype, Mbg. 1828); B, Aguada El Oro (Hi 890306/1/1); C, Agua del Carréton (NMB J 31200); D, E, Quebrada del Oreganito (D = Hi 790310/2/1, E = Hi 790310/2/2).
F - H = *Caracoliceras cf. dunkeri* (STEINMANN): F, G, Quebrada San Pedro (F = Hi 811024/12/2, G = Hi 811024/12/1); H, Cerro Huantajaya area (Ko 290194/8).
I - Q = *Caracoliceras* sp. A: I - N, Cerro Augusta Victoria (I = Gr 41281/4/4, J = Gr 41281/4/2, K = Gr 41281/4/1, L = Gr 41281/3/5, M = Gr 41281/3/1, N = Gr 41281/3/6); O, Cerro Jaspe (Gr 850323/1/1); P, Quebrada Los Tarros (Wi 250397/F2); Q, Cerro Amarillo (Hi 811112/3/1).
R = *Caracoliceras* sp. B: Cerro Amarillo (Hi 830218/2).
**Type locality:** Area of Caracoles, northern Chile.

**Type horizon:** Unknown.

**Material:** One incomplete mould of phragmocone with partly preserved and crushed body-chamber of about quarter-whorl (Mbg. 1828, holotype, Caracoles); two moulds of phragmocones (Hi 790310/2/1, -2, Quebrada del Oreganito); one mould with nearly complete body-chamber, one fragment with partially preserved phragmocone and body-chamber (Hi 830309/8/1, -2, Aguada El Minero); one large unilateral preserved mould of phragmocone, one unilateral preserved mould of phragmocone with body-chamber of up to four-fifths of a whorl, one fragment with part of body-chamber (Hi 890306/1/1, -2, /3, Aguada El Oro); one incomplete mould of phragmocone with partly preserved body-chamber (NMB J 31200, Agua del Carreton); two fragmentary internal moulds of phragmocones (USNM 508949, USNM 508950; collection W. BIESE, Cerritos Bayos). Investigated specimens with partial remains of shell.

**Diagnosis:** Whorl section depressed-subrounded. Umbilicus deep with rounded shoulders and slightly undercut umbilical wall. Ornamentation irregular with simple, bi-, triplicate and polygyrate ribs, and intercalatories. General trend of ribbing is more or less reverse sinuous. Ornamentation on the outer whorls is characterized by broad and flat primaries and by secondaries.

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**Fig. 4:** Whorl sections and suture line of *Caracoliceras* n. gen.:

A-C = *Caracoliceras dunkeri* (STEINMANN): A, Caracoles (holotype, Mbg. 1828); B, Quebrada del Oreganito (E = Hi 790310/2/2); C, Agua del Carreton (NMB J 31200).

D-E = *Caracoliceras* cf. *dunkeri* (STEINMANN): Quebrada San Pedro (D = Hi 811024/12/1, E = Hi 811024/12/4).

F-G = *Caracoliceras* sp. A: F, Quebrada Los Tarros (Wi 250397/F2); G, Cerro Augusta Victoria (Gr 41281/4/3).
which dissolve into fine striae. Constrictions irregular and not frequent.

### Dimension:

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**Description:** Shell moderately evolute to evolute, whorl section broader than high (see Fig. 4 A-C). Umbilicus widths vary between 36% - 46% of diameter depending on growth stages and specimens (see Fig. 5). Rounded umbilical shoulders and slightly undercut umbilicus wall. Ribbing irregular (see Fig. 3 A-E); inner whorls with mainly biplicate ribs, later with simple, bi-, triplicate and polyygryte ribs, and intercalatories. Primaries proconcave on umbilical wall and proradiate on whorl sides. Points of division between the middle and the ventral third of the whorl side. Secondaries are slightly proradiate to convex. A ventral interruption of ribs is absent or not so pronounced through a weak, thin band. Ornamentation on the outer whorls of adult specimens with broad and flat primaries and weak secondaries, which have the tendency to dissolve into fine striae. Fine striae could be observed only by shell preservation (see Pl. I, fig. 1 D), moulds without remains of shell appear smooth. The beginning of ornamentation of outer whorls is very variable and is dependent on specimen. Constrictions irregular and not frequent.

**Remarks:** Differences to Caracoliceras cf. dunkeri, C. sp. A, and C. sp. B see there.

**Temporal range:** Dunkeri Zone (Lower Oxfordian - ?Middle Oxfordian).

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### Caracoliceras cf. dunkeri

Pl. III, fig. 2-6; Fig. 3 F-H; Fig. 4 D-E; Fig. 5 E

1998. «Perisphinctes» dunkeri (STEINMANN).-KOSSLER, p. 121; pl. 13, figs. 2-6.

**Material:** Four fragments of phragmocones, one fragmentary preserved mould with partly preserved body-chamber, two fragmentary preserved moulds with crushed parts of body-chambers, up to half a whorl (Hi 811024/12/1-7, Quebrada San Pedro); one whorl-fragment of body-chamber and fragments of phragmocone (Ko 290194/8, Cerro Huantajaya area).

### Dimension:

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<th>p</th>
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<td>36</td>
<td>38</td>
<td>0,82</td>
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<td>0,82</td>
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**Description:** Shell moderately evolute to evolute. Whorl section subsquarish with rounded venter and flat whorl sides (see Fig. 4 D). Umbilicus deep with rounded umbilicus shoulders and somewhat undercut umbilicus wall. Ornamentation is the same as of the dunkeri specimens (see Fig. 3 F-H). Some specimens show a ventral interruption of ribs by a weak, thin band. Suture lines could be well-observed on the partially preserved phragmocone Hi 811024/12/2 (see Fig. 4 E); the outer whorl-fragment of this specimen shows the outer whorl ornamentation of adult specimens with broad and flat primaries and into fine striae dissolved secondaries.

**Remarks:** In the investigated material Caracoliceras cf.
Fig. 5: Diagram of coiling mode of the umbilical spiral. Plots of radius against wh' (wh' = whorl height not covered by the following whorl) for Caracoliceras n. gen:

a - d, f = Caracoliceras dunkeri (STEINMANN): a, b, Quebrada del Oreganito (a = Hi 790310/2/1, b = Hi 790310/2/2); c, Aguada El Minero (Hi 830309/8/1); d, Aguada El Oro (Hi 890306/1/1); f, Agua del Carreton (NMB J 31200).

e = Caracoliceras cf. dunkeri (STEINMANN): Quebrada San Pedro (Hi 811024/12/1).
dunkeri differs from the specimens attributed to C. dunkeri and the holotype in its more compressed whorl sections and its flat whorl sides at comparable growth stages.

**Temporal range:** Dunkeri Zone (Lower Oxfordian - ?Middle Oxfordian).

### Caracoliceras sp. A

*Pl. IV, figs. 1-13; Fig. 3 I-Q; Fig. 4 F-G*

**Material:** Whorl-fragments of body-chambers, with partial remains of shell (Gr 41281/3/1-6, Gr 41281/4/1-4, Augusta Victoria); one poorly, unilateral and partly crushed preserved fragment of phragmocone (Hi 811112/3/1, Cerro Amarillo); one whorl-fragment of phragmocone with shell preservation (Gr 850323/1/1, Cerro Jaspe); whorl-fragments (Ko 260194/4, Cerro Huantajaya area); one fragment of phragmocone with partly preserved shell (Hi 850339/7/3, Quebrada Los Tarros).

**Description:** Shell moderately evolute. Whorl section subrounded with rounded venter, rounded umbilical shoulders and somewhat undercut umbilical wall (see Fig. 4 F-G). Ornamentation in general relatively dense, appearing somewhat irregular with simple, bi-, triplicate and polygyrate ribs, and intercalatories (see Fig. 3 I-Q). Primaries proconcave on the umbilical wall and proradiate on the whorl sides. Points of division approximately at the middle of the whorl side. Secondaries more or less proradiate. Constrictions irregular and scarce.

**Remarks:** *Caracoliceras* sp. A differs from *Caracoliceras dunkeri*, *C. cf. dunkeri*, and *C. sp. B* in its denser ribbing and the less depressed whorl section. The present fragments cannot certainly be recognized at the specific level because of their poor preservation.

**Temporal range:** Dunkeri Zone (Lower Oxfordian - ?Middle Oxfordian).

### Caracoliceras sp. B

*Pl. IV, fig. 14; Fig. 3 R*

**Material:** One unilateral and fragmentary preserved mould with shell preservation (Hi 830218/2, Cerro Amarillo).

**Dimension:**

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<th>p</th>
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<th>w</th>
<th>u</th>
<th>h/w</th>
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<tbody>
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<td>32</td>
<td>41</td>
<td>41</td>
<td>0,8</td>
<td>66/2</td>
</tr>
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</table>

**Description:** Shell evolute. Whorl section subquarish with rounded venter. Type of ribbing appears somewhat irregular with simple, bi-, triplicate and polygyrate ribs, and intercalatories (see Fig. 3 R). Ornamentation significantly reverse sinuous; primaries proconcave on the umbilical wall and proradiate on the whorl sides, secondaries bend in a slightly convex manner and cross the venter uninterruptedly. Points of division low-lying, approximately on the inner half of the whorl side. Inner whorls not preserved. Constrictions irregular and not frequent.

**Remarks:** *Caracoliceras* sp. B differs from *Caracoliceras dunkeri, C. cf. dunkeri*, and *C. sp. A* in its significantly reverse sinuous ribbing and the low-lying points of division. Due to the poor preservation and the few material, the present specimen cannot be recognized at the specific level.

**Temporal range:** Dunkeri Zone (Lower Oxfordian - ?Middle Oxfordian).

### ACKNOWLEDGEMENTS

The present research was carried out under the Research Group «Mobilität aktiver Kontinentalränder» and the Special Research Project 267 «Deformationsprozesse in den Anden» of the German Research Foundation. Mrs. B. DUNKER (drafting), Mr. B. KLEEBERG (photography), and Mrs. Dr. A. CZEKAY (correcting our English) assisted in preparing the article.

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**Plate I**

(All fig. nat. size)

**Fig. 1 - 5:** *Caracoliceras dunkeri* (STEINMANN)

1 A - D: Caracles; phragmocone and part of crushed body-chamber (Mbg. 1828, holotype).

2, 3: Quebrada del Oreganito; 2 A - D, phragmocone (Hi 790310/2/1); 3 A, B, phragmocone (Hi 790310/2/2).

4, 5: Cerritos Bayos; 4 A - D, incomplete preserved phragmocone (USNM 508949); 5 A, B, inner whorls of phragmocone (USNM 508950).
REFERENCES


Plate II

(All fig. nat. size)

Fig. 1 - 5: Caracoliceras dunkeri (STEINMANN)
1, 5: Aguada El Minero; 1, internal mould with ?nearly complete body-chamber, only one side preserved (Hi 830309/8/1); 5, fragment with parts of phragmocone and body-chamber (Hi 830309/8/2).
2 - 4: Aguada El Oro; 2 A, B, phragmocone with up to four-fifths of body-chamber, only one side preserved (Hi 890306/1/1); 3, fragment with parts of phragmocone and body-chamber, only one side preserved (Hi 890306/1/2); 4 A, B, phragmocone, only one side preserved (Hi 890306/1/3).
Fig. 1: *Caracoliceras dunkeri* (STEINMANN)
1 A, B: Agua del Carretón; phragmocone and part of body-chamber (NMB J 31200).

Fig. 2-6: *Caracoliceras cf. dunkeri* (STEINMANN)
2 - 6: Quebrada San Pedro; 2 A - C, phragmocone and fragmentary preserved part of crushed body-chamber (Hi 811024/12/1); 3 A, B, incomplete preserved phragmocone and body-chamber (Hi 811024/12/2); 4, incomplete preserved phragmocone and crushed body-chamber (Hi 811024/12/3); 5 A, B, fragment of phragmocone (Hi 811024/12/4); 6, fragmentary preserved phragmocone (Hi 811024/12/5).
Fig. 1 - 13: *Caracoliceras* sp. A

1 - 10: Cerro Augusta Victoria; 1 A, B, poorly preserved fragment of body-chamber (Gr 41281/4/1); 2 A, B, fragment of body-chamber (Gr 41281/4/2); 3 A - C, poorly preserved fragment of body-chamber (outer whorl) and phragmocone (Gr 41281/4/3); 4, incomplete and slightly crushed specimen (Gr 41281/4/4); 5, slightly crushed fragment of body-chamber (Gr 41281/3/1); 6, slightly crushed fragment of body-chamber (Gr 41281/3/2); 7, fragment of body-chamber (Gr 41281/3/3); 8, fragment of body-chamber (Gr 41281/3/4); 9 A, B, slightly crushed fragment of body-chamber (Gr 41281/3/5); 10 A, B fragment of body-chamber (Gr 41281/3/6).

11: Quebrada Los Tarros; fragment of phragmocone and body-chamber (Wi 250397/F2).

12 A, B: Cerro Jaspe; slightly crushed fragment of body-chamber (Gr 850323/1/1).

13: Cerro Amarillo; crushed phragmocone and body-chamber (Hi 811112/3/1).

Fig. 14: *Caracoliceras* sp. B

14 A, B: Cerro Amarillo; poorly preserved fragment of phragmocone (Hi 830218/2).