Stuttgarter Beiträge zur Naturkunde
Serie B (Geologie und Paläontologie)

Herausgeber:

Staatliches Museum für Naturkunde, Rosenstein 1, D-70191 Stuttgart

Stuttgarter Beitr. Naturk.	Ser. B	Nr. 347	15 pp., 8 figs.	Stuttgart, 15. 4. 2004

Psiloceratids of the earliest Jurassic in the North-West European and Mediterranean Provinces – Remarks and new observations

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Abstract

The traditional correlation of the basal Jurassic between the Mediterranean and the NW European Provinces by *Psiloceras calliphyllum – Ps. psilonotum* is discussed. Special correlation potential have *Neophyllites* and alpine *Psiloceras* with reduced suture line. A comparatively rich material of *Neophyllites* from the Calliphyllum Zone representing *N. neumayri* Lange and *N.* cf. *trossingensis* (M. Schmidt) from two localities is described. It is concluded that the bases of the Planorbis and the Calliphyllum Zones can be correlated.

Keywords: Stratigraphy, System boundary, Lower Jurassic, Calcareous Alps, *Psiloceras*, *Neophyllites*.

Zusammenfassung

Die herkömmliche Parallelisierung der Basis des Juras zwischen der Mediterranen und der Nordwesteuropäischen Faunenprovinz durch *Psiloceras calliphyllum – Ps. psilonotum* wird erörtert. Eine besonders gute Korrelierungsmöglichkeit bieten *Neophyllites* und alpine *Psiloceras* mit vereinfachter Lobenlinie. Ein vergleichsweise reiches Material der Gattung *Neophyllites* aus der Calliphyllum-Zone zweier Lokalitäten, bestehend aus *N. neumayri* Lange und *N.* cf. *trossingensis* (M. Schmidt), wird beschrieben. Der Vergleich lässt darauf schließen, dass die Untergrenzen der Planorbis- und der Calliphyllum-Zone korreliert werden können.

1. Introduction

To find out a time plane best suitable as Triassic/Jurassic system boundary, reliable correlations between faunal provinces are necessary. The present paper contributes further observations on the relations between the earliest Jurassic ammonite faunas of the Northwest European and the Mediterranean Provinces.

The earliest fauna of the NW European Province is represented in the Planorbis Subzone. The fauna consists of different species of essentially smooth-shelled forms. These forms are not coeval as formerly assumed. Some sections, particularly the

Wilkesley Borehole in northwestern England, have revealed a succession as follows (from bottom to top): *Psiloceras erugatum*, *Neophyllites imitans*, *Neophyllites antecedens*, *Psiloceras planorbis*, *Psiloceras psilonotum* (in England regarded as synonymous with *Ps. sampsoni*), *Psiloceras psilonotum* + *Psiloceras plicatulum* (BLOOS & PAGE 2000, fig. 4).

In large parts of the NW European Province exists a gap between Triassic and Jurassic. There generally the Jurassic ammonite succession begins with *Psiloceras psilonotum*, mostly associated with *Psiloceras plicatulum*. Formerly, many authors regarded *Ps. psilonotum* as synonymous with *Ps. planorbis*, therefore in older literature this name generally means *Ps. psilonotum* if used in the Province except of Britain. The difference between both species is demonstrated in BLOOS & PAGE (2000, fig. 2).

In the Mediterranean Province as represented in the Northern Calcareous Alps the earliest ammonite fauna is comprised in the Zone of *Psiloceras calliphyllum*. Rich, well-preserved and diverse is this fauna only in a strongly condensed facies. In this fauna only one smooth-shelled psiloceratid species is frequent and well-known thus far, *Psiloceras calliphyllum*. The other psiloceratids described in LANGE (1952) are ribbed. These are *Psiloceras naumanni*, *Ps. costosum*, *Ps. strongolum*, *Ps. trochoeides*, *Ps. gernense*. The Calliphyllum Zone contains also *Caloceras*, *Waehneroceras* and some *Kammerkarites* (LANGE 1952, BLIND 1963), groups which occur in the NW European Province throughout above the Planorbis Subzone, i.e. in the Johnstoni Subzone of the Planorbis Zone and in the Liasicus Zone. These forms are not regarded here in detail.

Abbreviations

IGPT	Institut für Geologie und Paläontologie der Universität Tübingen
HNS	Haus der Natur Salzburg
NHMW	Naturhistorisches Museum Wien
SMNS	Staatliches Museum für Naturkunde Stuttgart

Acknowledgements

I want to thank for the loan of specimens by Naturhistorisches Museum Wien (Dr H. SUMMESBERGER), Haus der Natur Salzburg (Dr E. GEISER), Institut für Geologie und Paläontologie der Universität Tübingen (Dr A. LIEBAU) and by the private collector G. WOLF, Hallein. I am also grateful to Prof. Dr A. v. HILLEBRANDT, Berlin, S. GRÄBENSTEIN, Bodelshausen, and R. VEIT, Velden a. d. Vils who donated specimens from the Calliphyllum Zone to the Staatliches Museum für Naturkunde Stuttgart. Ms. R. HARLING assisted to produce the photos. For successful cooperation in the field the author is particularly indebted to S. GRÄBENSTEIN, Bodelshausen. The English was checked by Dr K. N. PAGE, Plymouth. For reviewing of this paper I thank Prof. Dr J. GUEX, Lausanne, and Prof. Dr A. v. HILLEBRANDT, Berlin.

2. Remarks on the relation between *Psiloceras psilonotum* and *Psiloceras calliphyllum*

Both species were mostly regarded as coeval and as geographical varieties. Supposed to be the beginning of the Jurassic ammonite succession, they were of special interest. Their relation has been discussed over more than 120 years. One of the last contributions to this issue and a historical review gave SCHLATTER (1994).

Both species show a striking coincidence in shape as already has been stated by

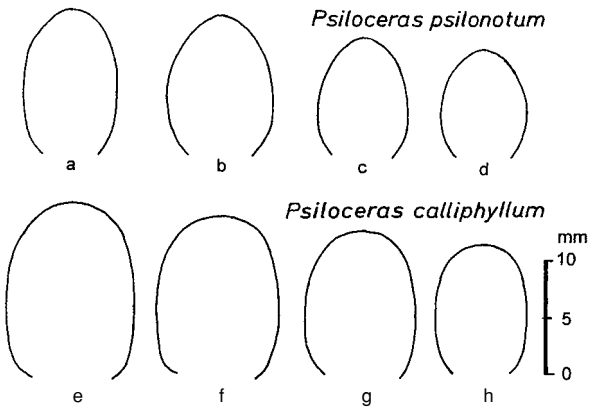

Fig. 1. Whorl sections of *Psiloceras psilonotum* and *Psiloceras calliphyllum.*
a: SMNS 64937; **b:** SMNS 64938; **c:** SMNS 64939; **d:** SMNS 64940 (v. HILLEBRANDT 2000, text-fig. 34 o); **e–h:** Coll. G. WOLF, Hallein.

NEUMAYR (1879), the author of *Ps. calliphyllum*. GUEX (1982) has demonstrated this coincidence in a diagram (1982, fig. 1). A slight difference exists in cross section of the whorls, the venter in *calliphyllum* tending to be somewhat broader and lower and the flanks less arched than in *psilonotum* (Fig. 1), but there is an overlap between both species.

There exists a difference in sculpture between both species, the general presence of nodes on the innermost whorls and often also a following stage of ribbing in *Ps. calliphyllum* whereas in *Ps. psilonotum* the innermost whorls are smooth as a rule. But also in this character there exists some overlap. There could be supposed a still closer relation of *Ps. calliphyllum* to *Ps. erugatum* because the latter species, in comparison with *Ps. psilonotum,* displays also nodes and ribbing on the inner whorls (BLOOS 1999b, text-fig. 4; BLOOS & PAGE 2000, pl. 1, figs. 13–15).

The main difference between *Ps. calliphyllum* and the four smooth-shelled NW European species of *Psiloceras* mentioned above (*Ps. erugatum*, *Ps. planorbis*, *Ps. psilonotum*, *Ps. sampsoni*) is the suture line. The difference is particularly seen in the saddles. In *Ps. calliphyllum* they are slender and higher and they are more deeply indentated, and most indentations show further subdivisions, i.e. indentations of second and even of third order (Figs. 7a, b). In the NW European *Psiloceras*, the saddles are low and broad, the indentations are conspicuously less deep and only a minority of indentations show further subdivision, sometimes none at all (Figs. 6a, b; COUSIN 1921, LANGE 1941, BLOOS & PAGE 2000). But in rare, extreme specimens the suture line of *Ps. psilonotum* may be more similar to *Ps. calliphyllum* without reaching it fully (Fig. 7c). Also the number of umbilical elements of the suture line can be higher in *Ps. calliphyllum* (SCHLATTER 1994), but this character is variable as well. The umbilical part of the suture line is often more strongly retracted in *Ps. calliphyllum* than in *Ps. psilonotum* (v. HILLEBRANDT 2000: 169).

The difference between *Psiloceras calliphyllum* and *Psiloceras psilonotum* is generally explained by differences of environment. It is one of the most cited examples of the ecological influence on suture lines. Indeed, the ammonite fauna of the Hettan-

gian in the Mediterranean Province is rich in forms displaying highly differentiated suture lines. In contrast, the majority of NW European ammonites of this time span displays comparatively simple suture lines. This suggests that ammonites migrating from the Mediterranean Province into the marginal sea of the NW European Province reduced their suture lines as seen in *Ps. calliphyllum.*

Two observations render this conclusion doubtful. First, there are important ammonite groups in the Mediterranean Province which did never appear in the NW European Province during the earliest Lias, e.g. all Phylloceratina and Lytoceratina, *Discamphiceras*, *Kammerkaroceras*, *Alpinoceras* and other alpine Alsatitinae (WÄHNER 1888, 1891; BLOOS 1994, text-figs. 2–3), *Pseudaetomoceras*, *Euphyllites* and some smaller groups. There must be mentioned also the majority of *Kammerkarites* and important alpine forms of *Schlotheimia*. In these groups most alpine ammonites with highly differentiated sutures are contained. Rarely such a form succeeded to live in the NW European Province. A well-known example is *Angulaticeras marmoreum* in the late Hettangian. This species, however, maintained its elaborated alpine suture line in the new environment (BLOOS 1988, text-fig. 10).

A second argument against a general reduction of the suture line in the new environment is that all ammonite groups of the NW European Province in the Hettangian have close relatives in the alpine sections which are not only comparable in shape and sculpture but also in suture line (examples in LANGE 1952, BLOOS 1994). There can be found relatives of *Caloceras*, *Curviceras* (the NW European group of *Waehneroceras*), *Saxoceras* (a special group of *Kammerkarites*), *Alsatites*, *Schlotheimia, Schreinbachites*. The presence of these forms indicates that also in the Tethys ammonites with simple suture line could exist. Moreover, the early arietitid genus *Schreinbachites* which is a rare, certainly immigrated faunal element in the NW European Province (BLOOS 1994) shows that forms with simple suture lines could develop within the Tethys. Doubtless in the Mediterranean Province different types of environments existed. Thus it can be concluded that particularly such forms succeeded to live in the NW European Province which had developed a suitable adaptation already in their home region.

The only exception seemed to be *Ps. calliphyllum* and its supposed transformation into *Ps. psilonotum* in the NW European Province. To date, there is merely one observation not well in accord with this view. One should expect that the arriving immigrants brought with them their original suture line as in the mentioned case of *Angulaticeras marmoreum* and then continuously reduced it. But even the earliest *Psiloceras*, *Ps. erugatum*, displays the same simple suture line as the later species (BLOOS & PAGE 2000, text-fig. 1). It is not clear if the later *Psiloceras* species are descendants of *Ps. erugatum* or not. The ammonite succession in the Planorbis Subzone mentioned above is not likely to be a monophyletic lineage. Even between the superimposed species *Ps. planorbis* and *Ps. psilonotum* does not exist a continuous transition though there cannot be recognized a gap in sedimentation (BLOOS & PAGE 2000: 30). Therefore different events of immigration seem possible. As shown below, forms of *Psiloceras* with simple suture line existed, indeed, in the Alps from which the NW European forms may be derived.

3. Psiloceratids of NW European type in alpine sections

Several times the occurrence of *„Psiloceras planorbis“* or *„Ps. psilonotum“* (both names mean the latter form) in the Alps has been mentioned in the literature (e.g. WÄHNER 1886: 136–137, LANGE 1952: 60, BLIND 1963: 45–46). In no case the specimens have been properly documented with exception of one figure of BLIND. So the problem of the occurrence of this species and the occurrence of NW European *Psiloceras* at all in the Alps remained unsolved till today.

All mentioned specimens were found at the same locality, Fonsjoch near Achensee in Austria. This locality is famous for its diverse and well-preserved ammonite fauna, particularly of the Calliphyllum Zone, since more than 130 years (PICHLER 1869).

BLIND (1963) mentioned 10 specimens of *Psiloceras planorbis* from Fonsjoch, nine of which are very small. He observed nodes on the innermost whorls what is also documented in his figured specimen (1963, pl. 1, fig. 1). Suture lines are not mentioned. The presence of nodes is a character which excludes *Ps. planorbis* as well as *Ps. psilonotum* which are smooth on the innermost whorls. The specimens are early ontogenetic stages or probably microconchs of *Psiloceras calliphyllum*.

WÄHNER's specimens (1886) are, according to his description and the recent study of other, still undescribed material, *Neophyllites* (see below). The specimens from Fonsjoch mentioned by LANGE (1952: 60) from the collection of the University of Innsbruck (Austria) have not yet been restudied; these specimens may well be also *Neophyllites*.

RAKÚS (1993, pl. 8, fig. 2) figured a specimen determined as *Ps. psilonotum* from the western Carpathians in a typically Tethyan ammonite assemblage. It is preserved as mould. In regard of whorl section and width of umbilicus mentioned in the text (RAKÚS 1993: 14) the determination may be true. But suture line and innermost whorls are not preserved.

Genus *Neophyllites* LANGE, 1941

Type species: *Psilophyllites antecedens* LANGE, 1931.

Thus far, the genus *Neophyllites* was known from the Mediterranean Province only by one specimen. The references listed below concern all this single specimen which was studied and figured several times. Thus, the genus seemed to be extremely rare in this Province.

In this situation it was a surprise to identify 24 specimens of the genus in the stratigraphic collection of the Naturhistorisches Museum at Vienna, all coming from Fonsjoch.

On the labels the specimens at Vienna are mostly indicated as *Psiloceras planorbis*, a few as *Psiloceras Hagenowi*. The labels give no further information such as year, collector or stratigraphic details. They are all of the same style; this style indicates the late 19th century.

It is not known whether the specimens were found together in an accumulation. This might at least partly be since the genus has never been found later at Fonsjoch (e.g. LANGE 1952, BLIND 1963; private collections). The matrix is not homogeneous. In some specimens the matrix is a light brown, fine-grained limestone without glauconite grains, but in more specimens the generally brown limestone is variegated by

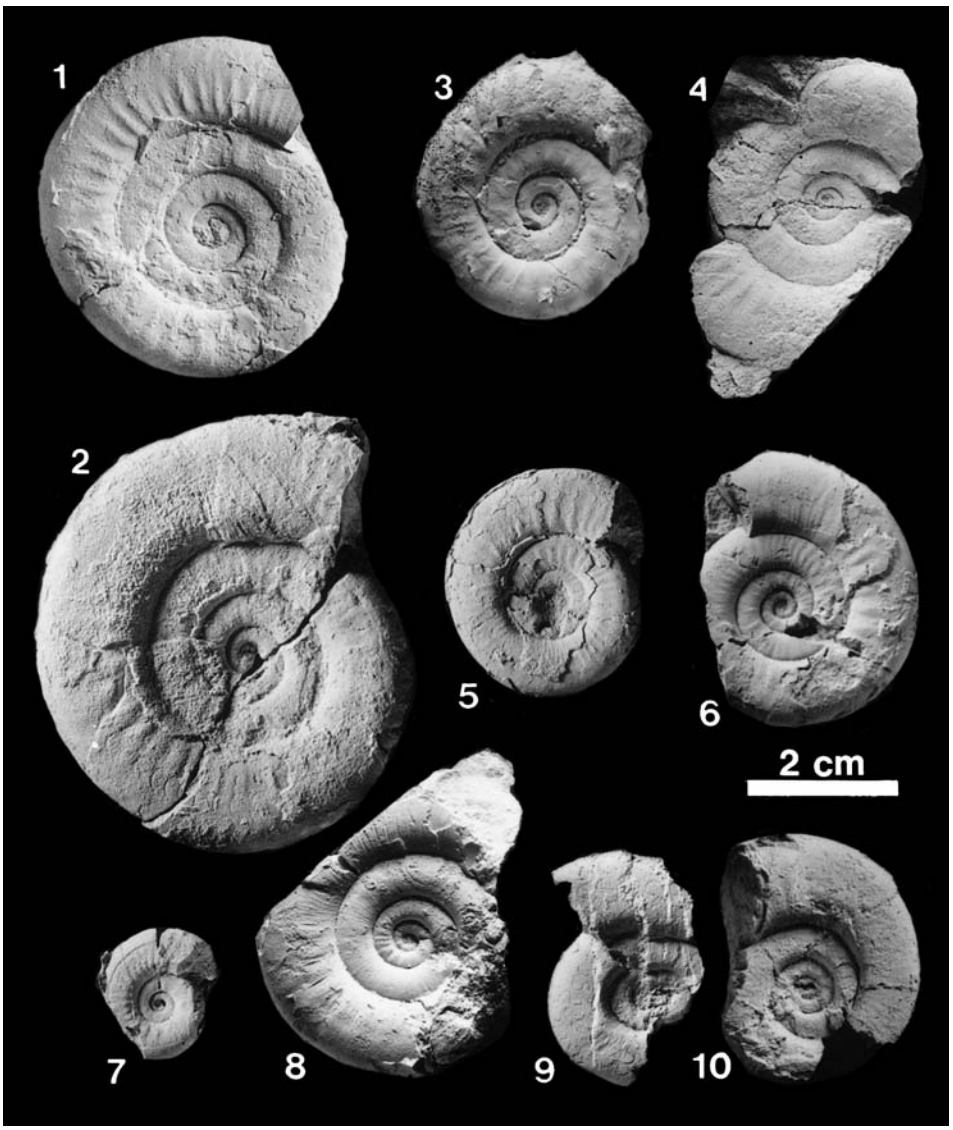

Fig. 2. Specimens **1–8:** *Neophyllites neumayri* LANGE, specimens **9–10:** *Neophyllites* cf. *trossingensis* (M. SCHMIDT). All specimens from Fonsjoch except for specimen 4 (from Baumgartenbach, 7 km NW of Fonsjoch). Suture lines are figured of specimens 1, 4, 5, 8 (Figs. 3f, c, a, h). Suture line of specimen 9 is similar to that of specimen 4, and suture line of specimen 10 to that of specimen 1. Cross sections are figured of specimens 6, 8, 9 10 (Figs. 4c, b, d, e).
1: NHMW 1987/35/36; **2:** NHMW 1987/35/48; **3:** NHMW 1987/35/49; **4:** SMNS 64861; **5:** NHMW 1987/35/44; **6:** NHMW 1987/35/51; **7:** NHMW 1987/35/38; **8:** NHMW 1987/35/50; **9:** NHMW 1987/35/54; **10:** NHMW 1987/35/53.

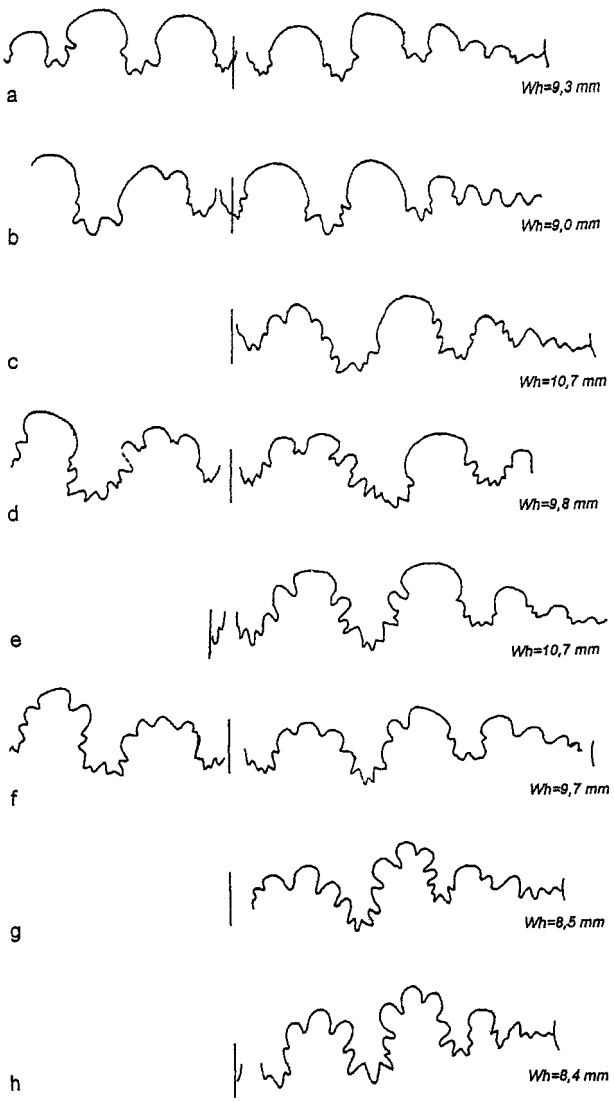

Fig. 3. Suture lines of *Neophyllites neumayri* LANGE. Specimens of a, c, f, h are figured in Fig. 2 (specimens 5, 4, 1, 8).
a: NHMW 1987/35/44; **b:** NHMW 1987/35/37; **c:** SMNS 64861; **d:** NHMW 1987/35/39; **e:** NHMW 1987/35/43; **f:** NHMW 1987/35/36; **g:** NHMW 1987/35/55; **h:** NHMW 1987/35/50.

grey and red patches and contains dark green glauconite grains and pelecypods. It is the same matrix in which also the usual fauna of the Calliphyllum Zone is embedded. That means that there is at least no sedimentological indication of a separate level of *Neophyllites* below *Ps. calliphyllum*.

The material can be allocated to *Neophyllites* on basis of three characters. First, the differentiation of the suture line shows the same variability as in the NW Euro-

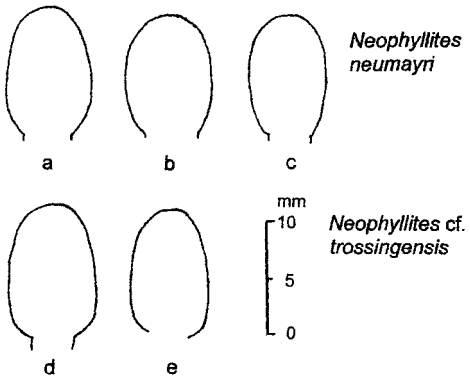

Fig. 4. Cross sections of alpine *Neophyllites*. Note the umbilical wall in d and e. Specimens b, c, d, e are figured in Fig. 2 (specimens 8, 6, 9, 10).
a: NHMW 1987/35/45; **b:** NHMW 1987/35/50; **c:** NHMW 1987/35/51; **d:** NHMW 1987/35/54; **e:** NHMW 1987/35/53.

pean *Neophyllites* (BLOOS 1999a, figs. 4–8; present paper, Figs. 3a–h); the difference to *Psiloceras* suture lines is demonstrated in the same paper (BLOOS 1999a, fig. 9). The indentations in the saddles are less deep and remain simple; subdivisions of second order are rare exceptions whereas a few of them often occur in the NW European *Psiloceras*. A second character of *Neophyllites* is that the umbilical part of the suture line mostly is not retracted (Fig. 3) whereas in *Psiloceras* it is generally retracted (Figs. 6, 7). The third character is the lack of nodes on the innermost whorls; rarely, there exists a weak, irregular undulation.

Neophyllites neumayri LANGE, 1952

Fig. 2, specimens 1–8; Figs. 3 a–h, 4a–c

1879 *Aegoceras* cf. *Hagenowi* Dkr. – NEUMAYR, p. 28, pl. 2, figs. 6a–c.
1941 *Neophyllites* cf. *antecedens* LANGE – LANGE, pp. 55, 57.
*1952 *Neophyllites antecedens neumayri* subsp. n. – LANGE, p. 90, pl. 10, figs. 3a–b.
1970 *Neophyllites biptychus* LANGE – WIEDMANN, p. 1011, pl. 10, figs. 3a–b.

Holotype (by monotypy): Orig. NEUMAYR (1879, pl. 2, figs. 6a–c), LANGE (1952: 90).
Material: 22 specimens from Fonsjoch in the Naturhistorisches Museum Wien, nos. 1987/35/36–57. One specimen from Baumgartenbach (7 km northwest of Fonsjoch), donated to the Staatliches Museum für Naturkunde Stuttgart by A. v. HILLEBRANDT, SMNS 64861.

Description. – 22 specimens from Fonsjoch and the one from Baumgartenbach can be allocated to *N. neumayri*. The specific characters have been listed by LANGE (1952). The two main characters differing the species from others of the genus can be observed in all specimens more or less. First, it is the flat umbilicus caused by the general lack of a steep umbilical wall. Second, it is the presence of a relatively dense ribbing mostly appearing after a smooth stage. The ribs are low and blunt; they are strongest at the umbilical margin of the flank. Often they are restricted to the umbilical half of the flank and fade out on the ventral half. In a few cases the strongest part of the ribs shifts to the middle of the flank in later stages of ontogeny.

The cross section of the whorls is slender, the flanks are rather flat. The width of the outer whorls is around 65% of the whorl height. The umbilicus could be mea-

sured in nine adult specimens. In eight specimens the width of umbilicus is about 45% of the diameter; in small specimens below 2 cm diameter it is less. One measured specimen (Fig. 2, specimen 1) is more wide-whorled, the umbilicus being 51% of the diameter; there is another almost identical fragmentary specimen of this type (NHMW 1987/53/45). In other characters the two specimens are not different from the species.

Differences. – The main difference to all other species of *Neophyllites* except of one is the presence of ribbing, partly also the lack of a distinct umbilical wall. The only other species with ribbing is *N. biptychus* LANGE, 1941. WIEDMANN (1970) regarded *N. biptychus* and *N. neumayri* as synonymous. LANGE mentioned bifurcation of the ribs as essential what is reflected also by the name of the species. In none of the alpine specimens this character has been observed. It might be that the bifurcation is an anomaly, but the variability of *N. biptychus* is unknown since there exist only two specimens of which only the type specimen is figured (LANGE 1941, pl. 2, fig. 1). *N. antecedens* is smaller, its umbilicus is wider and its sculpture is irregular and very weak, often the outer whorls are smooth (BLOOS 1999a, fig. 2, specimen 1). In spite of these differences *N. neumayri* is closely related to both NW European species, *N. antecedens* and *N. biptychus*.

Neophyllites cf. *trossingensis* (M. SCHMIDT, 1925, in LANGE 1925)

Fig. 2, specimens 9–10; Figs. 4d–e

Two specimens of *Neophyllites* from Fonsjoch differ from *N. neumayri* by the narrower umbilicus, the presence of a better developed umbilical wall and the lack of ribbing. These specimens are most similar to the NW European *N. trossingensis*; the main difference is the umbilical wall which is higher in *N. trossingensis*.

Remarks. – v. HILLEBRANDT (2000) compared his new species *Psiloceras pressum* from South America (Chile) with *Neophyllites* (2000: 167–168, suture lines text-figs. 34c–k). The flat flanks and the simple suture line with not retracted umbilical part are, indeed, similar. Different are the well developed nodes on the innermost whorls and the occurrence of subdivided indentations (indentations of second order) in the suture line. Most probably *Ps. pressum* is a form convergent with *Neophyllites*.

YIN & ENAY (2000) mentioned *Neophyllites* sp. from the eastern Himalaya (South Tibet) (text-fig. 2, specimen 15). But the characters diagnostic of *Neophyllites* have not yet been demonstrated.

Genus *Psiloceras* HYATT, 1867

Type species: *Ammonites planorbis* SOWERBY, 1824.

The species of *Psiloceras* described thus far from the Mediterranean Province (LANGE 1952) display two characters in common, the suture line of *calliphyllum* type and nodes on the innermost whorls. Formerly they were comprised in the subgenus *Paraphylloceras* SALFELD, 1919. Because of some overlap of characters in Mediterranean and NW European *Psiloceras*, generally the subgenus is no more used and it may informally be spoken of *calliphyllum* group and *psilonotum* group.

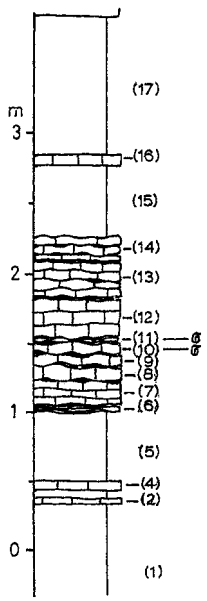

Fig. 5. Section in the Glasenbach gorge in Salzburg, a sequence of grey marls and limestones. The two limestone beds with ammonites of the Calliphyllum Zone are indicated. From other beds suitable fossils are lacking, therefore a stratigraphic subdivision of the section is not possible.

Psiloceras cf. *psilonotum* and sp. indet.
Figs. 6c–d, 7d

In the material kept in the „Haus der Natur" at Salzburg (Austria) a few specimens of *Psiloceras* with reduced suture line have been found. The ammonites came from the locality of Glasenbachklamm (Glasenbach gorge) at the southern margin of Salzburg (BERNOULLI & JENKYNS 1970), a small, forested valley with steep slopes. There in a sequence of grey marls and limestones, two superimposed limestone beds separated by a marl layer contain ammonites of the Calliphyllum Zone (beds 10, 11 in Fig. 5). Now the valley is a protected area and excavations are no more possible. Material from there is also in the private collection of G. WOLF, Hallein near Salzburg.

The material of this locality in the collections came almost completely from the upper limestone bed because it is marly and therefore preparation is easier. This bed contains *Psiloceras calliphyllum*, *Ps. naumanni*, *Caloceras convolvulum*, *Waehneroceras (Curviceras) curvicorne*, *Kammerkarites frigga* and some special *Psiloceras* (see below). *Waehneroceras tenerum* and related forms could not be identified in the available material. Most specimens are *Psiloceras*, other genera are represented only in a few specimens, most of them being *Caloceras*. The assemblage indicates some condensation with levels corresponding with the NW European Johnstoni Subzone and probably transition to the Liasicus Zone. It seems possible that the fauna of the lower limestone bed is not condensed. Unfortunately this cannot be proved on basis of the present material.

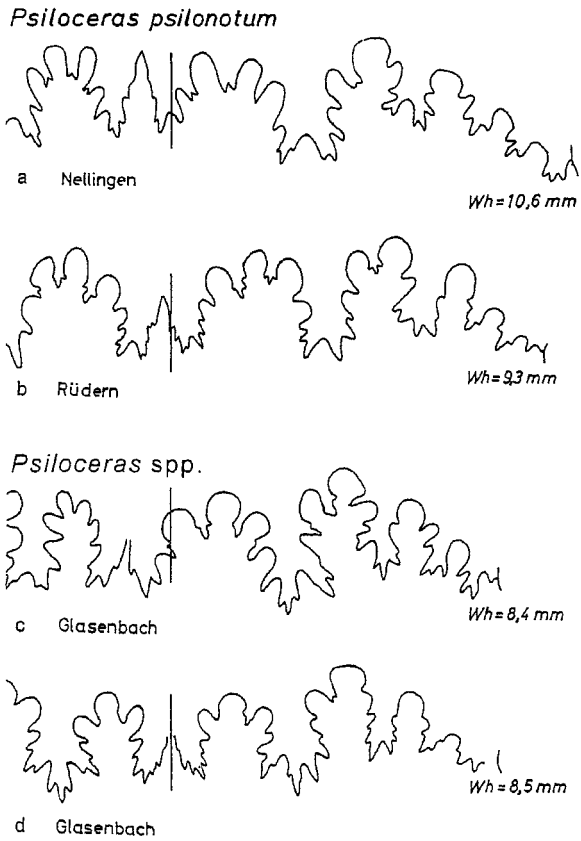

Fig. 6. Alpine *Psiloceras* spp. (essentially smooth-shelled) with reduced suture lines (c, d) in comparison with suture lines of NW European *Psiloceras psilonotum* (a, b). See also Fig. 7d. **a:** SMNS 64863; **b:** SMNS 64864; **c:** HNS 19965; **d:** HNS 30386.

A small, smooth-shelled *Psiloceras* (diameter 30 mm, Salzburg coll. no. 30386) with narrow venter could be well *Ps. psilonotum* according to the suture line (Fig. 6d), but the innermost whorls are not preserved and therefore it remains uncertain whether they are smooth.

A very wide-whorled specimen of *Psiloceras* with weak, dense ribbing (diameter 49 mm; Salzburg coll. no. 19965) cannot be allocated to a known species. The innermost whorls are smooth. The suture line (Fig. 6c) is within the variability of NW European *Psiloceras*.

Recently, from the locality Baumgartenbach (Austria) a suture line of *psilonotum* type has been figured by v. HILLEBRANDT (2000, text-fig. 34 o; here refigured in Fig. 7d). On the innermost whorls of this smooth-shelled *Psiloceras* nodes are developed. The combination of simple suture line and nodes is characteristic of *Psiloceras erugatum*. Only the strongly retracted umbilical part of the suture line may indicate *Ps. calliphyllum*.

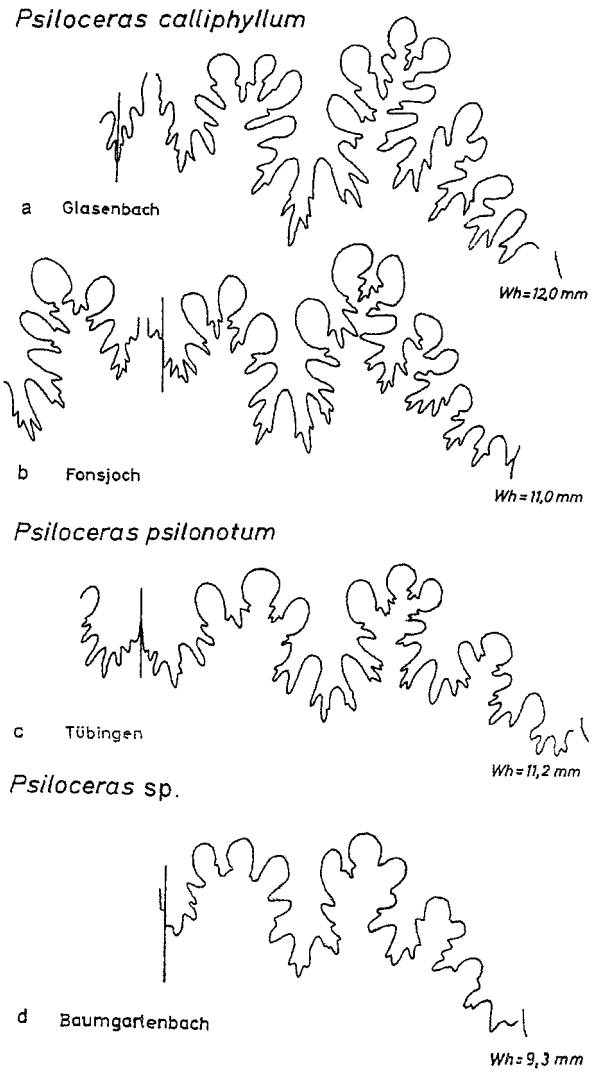

Fig. 7. Most differentiated suture line of NW European *Psiloceras psilonotum* (c) in comparison with suture lines of *Psiloceras calliphyllum* (a, b). *Psiloceras* sp. (d) is alpine, figured in v. HILLEBRANDT (2000, text-fig. 34 o, reversed), it is within the variability of *Psiloceras psilonotum* and *Psiloceras erugatum*.
a: HNS 30367; **b:** SMNS 64862; **c:** IGPT 1831/52 (Coll. WETZEL no. 2096); **d:** SMNS 64940 (v. HILLEBRANDT 2000, text-fig. 34 o).

Psiloceras plicatulum (QUENSTEDT, 1883)
Figs. 8a–d

In the NW European Province *Psiloceras psilonotum* is mostly associated with *Psiloceras plicatulum*. It is the latest *Psiloceras* of the Planorbis Subzone but does not

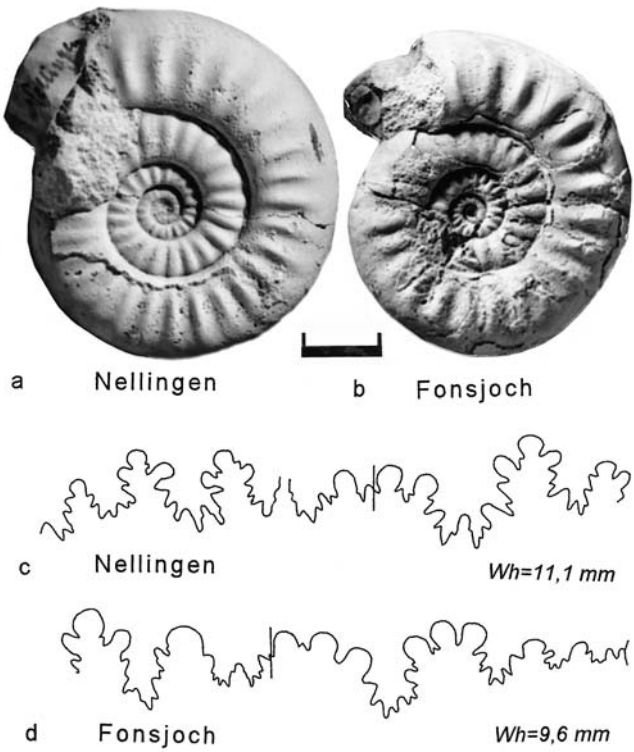

Fig. 8. *Psiloceras plicatulum*, NW-European and Mediterranean. Scale 1 cm.
a: SMNS 64866; **b:** SMNS 64865; **c:** SMNS 64866; **d:** SMNS 64865.

persist into the Johnstoni Subzone. Therefore it is the index of the latest part of the Planorbis Subzone.

A specimen of *Psiloceras plicatulum* from Fonsjoch (Figs. 8b, d) is kept in the Stuttgart collection (originally in the collection W. LANGE) which in every respect perfectly coincides with specimens of the NW European Province (Figs. 8a, c). This is an indication that also *Psiloceras psilonotum* can be expected from Fonsjoch. Further search in collections is necessary.

4. Stratigraphic result

The occurrence of *Psiloceras plicatulum* and most probably *Psiloceras psilonotum* in the Calliphyllum Zone admits a direct correlation with the NW European Planorbis Subzone. The alpine *Neophyllites* offer a further good correlation within the Planorbis Subzone. At least in regard of stratigraphy, a discussion on the relation *Ps. calliphyllum – Ps. psilonotum* is no more necessary. If *Ps. calliphyllum* is restricted to the Planorbis Subzone or persists into the Johnstoni Subzone is uncertain. The co-occurrence of this species and *Caloceras* may be merely an effect of condensation.

In the Mediterranean Province the record of ammonoids is discontinuous between the last fossils indicating Triassic (mostly conodonts) and the first Jurassic ammonites. The intermediate, ammonite-barren beds (GOLEBIOWSKI & BRAUNSTEIN 1988, text-figs. 3–5) can be compared with the Pre-Planorbis Beds of the NW European Province. Ammonites must have existed also in this time but they are not known. The supposed accumulation of *Neophyllites* may well indicate an earlier level than the rest of the Calliphyllum Zone. Then they would be the earliest Jurassic ammonites known in the Alps. Thus far, equivalents of *Ps. erugatum* and its horizon are not unequivocally identified but may be expected according to the single specimen mentioned above. Thus, the bases of the Planorbis and the Calliphyllum Zones are not very different and may well be correlated.

5. References

BERNOULLI, D. & JENKYNS, H. C. (1970): A Jurassic Basin: The Glasenbach Gorge, Salzburg, Austria. – Verhandlungen der Geologischen Bundesanstalt, **1970**: 504–531.

BLIND, W. (1963): Die Ammoniten des Lias Alpha aus Schwaben, vom Fonsjoch und Breitenberg (Alpen) und ihre Entwicklung. – Palaeontographica, Abteilung A, **121**: 38–131.

BLOOS, G. (1988): *Ammonites marmoreus* OPPEL (Schlotheimiidae) im unteren Lias (*angulata*-Zone, *depressa*-Subzone) von Württemberg (Südwestdeutschland). – Stuttgarter Beiträge zur Naturkunde, Serie B, **141**: 47 pp.

BLOOS, G. (1994): Frühe Arietitidae (Ammonoidea) aus dem Hettangium (Angulata-Zone, Unt. Lias) von Württemberg (SW-Deutschland). – Stuttgarter Beiträge zur Naturkunde, Serie B, **219**: 67 pp.

BLOOS, G. (1999a): *Neophyllites* (Ammonoidea, Psiloceratidae) in the earliest Jurassic of South Germany. – Neues Jahrbuch für Geologie und Paläontologie, Abhandlungen, **211**: 7–29.

BLOOS, G. (1999b): Aspekte der Wende Trias/Jura. – In: HAUSCHKE, N. & WILDE, V. (eds.): Trias – eine ganz andere Welt. Mitteleuropa im frühen Erdmittelalter: 43–68, München (Pfeil).

BLOOS, G. & PAGE, K. N. (2000): The basal Jurassic ammonite succession in the North-West European Province – review and new results. – In: HALL, R. L. & SMITH, P. L. (eds.): Advances in Jurassic Research 2000. Proceedings of the Fifth International Symposium on the Jurassic System. – GeoResearch Forum, **6**: 27–40.

COUSIN, G. (1921): Sur les variations individuelles de *Psiloceras planorbis* SOW. – Comptes rendus des séances de l'Académie des Sciences Paris, **172**: 1369–1372.

GOLEBIOWSKI, R. & BRAUNSTEIN, R. E. (1988): A Triassic/Jurassic boundary section in the Northern Calcareous Alps (Austria). – Berichte der Geologischen Bundesanstalt, **15**: 39–46.

GUEX, J. (1982): Relations entre le genre *Psiloceras* et les Phylloceratida au voisinage de la limite Trias-Jurassique. – Bulletin de la Société Vaudoise des Sciences Naturelles, **76**: 47–51.

HILLEBRANDT, A. v. (2000): Die Ammonitenfauna des südamerikanischen Hettangium (basaler Jura), Teil I. – Palaeontographica, Abteilung A, **257**: 85–189.

HYATT, A. (1867): The fossil Cephalopods of the Museum of Comparative Zoology. – Bulletin of the Museum of Comparative Zoology, **1**: 71–102.

LANGE, W. (1931): Die biostratigraphischen Zonen des Lias und Vollraths petrographische Leithorizonte. – Centralblatt für Mineralogie, Geologie und Paläontologie, **1931**, Abteilung B: 349–372.

LANGE, W. (1941): Die Ammonitenfauna der Psiloceras-Stufe Norddeutschlands. – Palaeontographica, Abteilung A, **93**: 1–192.

LANGE, W. (1952): Der untere Lias am Fonsjoch (östliches Karwendelgebirge) und seine Ammonitenfauna. – Palaeontographica, Abteilung A, **102**: 49–162.

NEUMAYR, M. (1879): Zur Kenntniss des untersten Lias in den Nordalpen. – Abhandlungen der Kaiserlich-Königlichen Geologischen Reichsanstalt, **7**: 46 pp.
PICHLER, A. (1869): Beiträge zur Geognosie und Mineralogie Tirols. – Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt, **19**: 207–216; Wien.
RAKÚS, M. (1993): Lias ammonites of the West Carpathians. Part one: Hettangian. – Západné Karpaty, Séria paleontológia, **17**: 7–40.
SALFELD, H. (1919): Über die Ausgestaltung der Lobenlinie bei Jura- und Kreide-Ammonoideen. – Nachrichten der Königlichen Gesellschaft der Wissenschaften Göttingen, mathematisch-physikalische Klasse, **1919**: 449–467.
SCHLATTER, R. (1994): Über phylogenetische Beziehungen zwischen *Psiloceras psilonotum* (QUENSTEDT) und *Psiloceras calliphyllum* (NEUMAYR) (Ammonoidea). – Stuttgarter Beiträge zur Naturkunde, Serie B, **218**: 13 pp.
WÄHNER, F. (1886–1891): Beiträge zur Kenntniss der tieferen Zonen des unteren Lias in den nordöstlichen Alpen. – Beiträge zur Paläontologie Österreich-Ungarns und des Orients, **4** (1886): 135–226; **6** (1888): 293–325; **8** (1891): 241–268.
WIEDMANN, J. (1970): Über den Ursprung der Neoammonoideen – Das Problem einer Typogenese. – Eclogae geologicae Helvetiae, **63**: 923–1020.
YIN, J. & ENAY, R. (2000): The earliest Jurassic psiloceratids in the Eastern Himalaya, South Tibet. – Comptes rendus de l'Académie des Sciences Paris, Série IIa, **331**: 601–608.

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Manuscipt received: 19. 1. 2004, accepted: 27. 2. 2004

ISSN 0341-0153

Autoren-Richtlinien: http://www.naturkundemuseum-bw.de/stuttgart/schriften
Schriftleitung: Dr. Ronald Böttcher, Rosenstein 1, 70191 Stuttgart
Gesamtherstellung: Gulde-Druck GmbH, 72072 Tübingen