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Discovery of *Neophyllites* (Ammonitina, Cephalopoda, Early Hettangian) in the New York Canyon sections (Gabbs Valley Range, Nevada) and discussion of the $\delta^{13}C$ negative anomalies located around the Triassic-Jurassic boundary[1]

Par

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Abstract.–GUEX J., BARTOLINI A. and TAYLOR D., 2002. Discovery of *Neophyllites* (Ammonitina, Cephalopoda, Early Hettangian) in the New York Canyon sections (Gabbs Valley Range, Nevada) and discussion of the $\delta^{13}C$ negative anomalies located around the Triassic-Jurassic boundary. *Bull. Soc. vaud. Sc. nat. 88.2*: 247-255.
Several morphotypes of *Neophyllites* from the *Odoghertyceras/Choristoceras minutus* beds of the New York Canyon (Gabbs Valley Range, Nevada) are described for the first time. The presence of these forms in North America allows a much better correlation of this stratigraphic interval with the coeval beds in North-West Europe.
In addition, we discuss the age of the negative $\delta^{13}C$ anomalies located around the Triassic-Jurassic boundary in England, Hungary and Canada. We demonstrate that the first two are located in Rhaetian sediments and the latter is located above the Triassic-Jurassic boundary.

Keywords: Triassic-Jurassic Boundary, ammonites, carbon isotopes anomalies.

Résumé.–GUEX J., BARTOLINI A. et TAYLOR D. 2002. Découverte de *Neophyllites* (Ammonitina, Cephalopoda) dans les sections du New York Canyon (Gabbs Valley Range, Nevada) et discussion des anomalies négatives du $\delta^{13}C$ situées au voisinage de la limite Trias-Jurassique. *Bull. Soc. vaud. Sc. nat. 88.2*: 247-255.
Nous décrivons ici pour la première fois des ammonites de la base du Jurassique appartenant au genre *Neophyllites* et provenant des couches à *Odoghertyceras/ Choristoceras minutus* du New York Canyon (Gabbs Valley Range, Nevada). Cette

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découverte permet d'améliorer substantiellement la corrélation entre le Jurassique basal de la province pacifique avec les coupes classiques de l'Europe du nord-ouest.
Dans la deuxième partie de ce travail, nous montrons que les anomalies négatives du $\delta^{13}C$ reconnues au voisinage de la limite Trias-Jurassique en Angleterre, Hongrie et Colombie Britannique (Canada) ne sont pas synchrones, les deux premières ayant un âge rhétien et la troisième ayant un âge Jurassique basal.

Mots clés: Limite Trias-Jurassique, ammonites, anomalies isotopiques du carbone.

Introduction

During the last few years we have published several papers giving increasingly more precise data about the stratigraphic distribution of bivalves and ammonites around the Triassic-Jurassic boundary in the New York Canyon (Gabbs Valley Range, Nevada) area: these data are summarised in Figure 1.

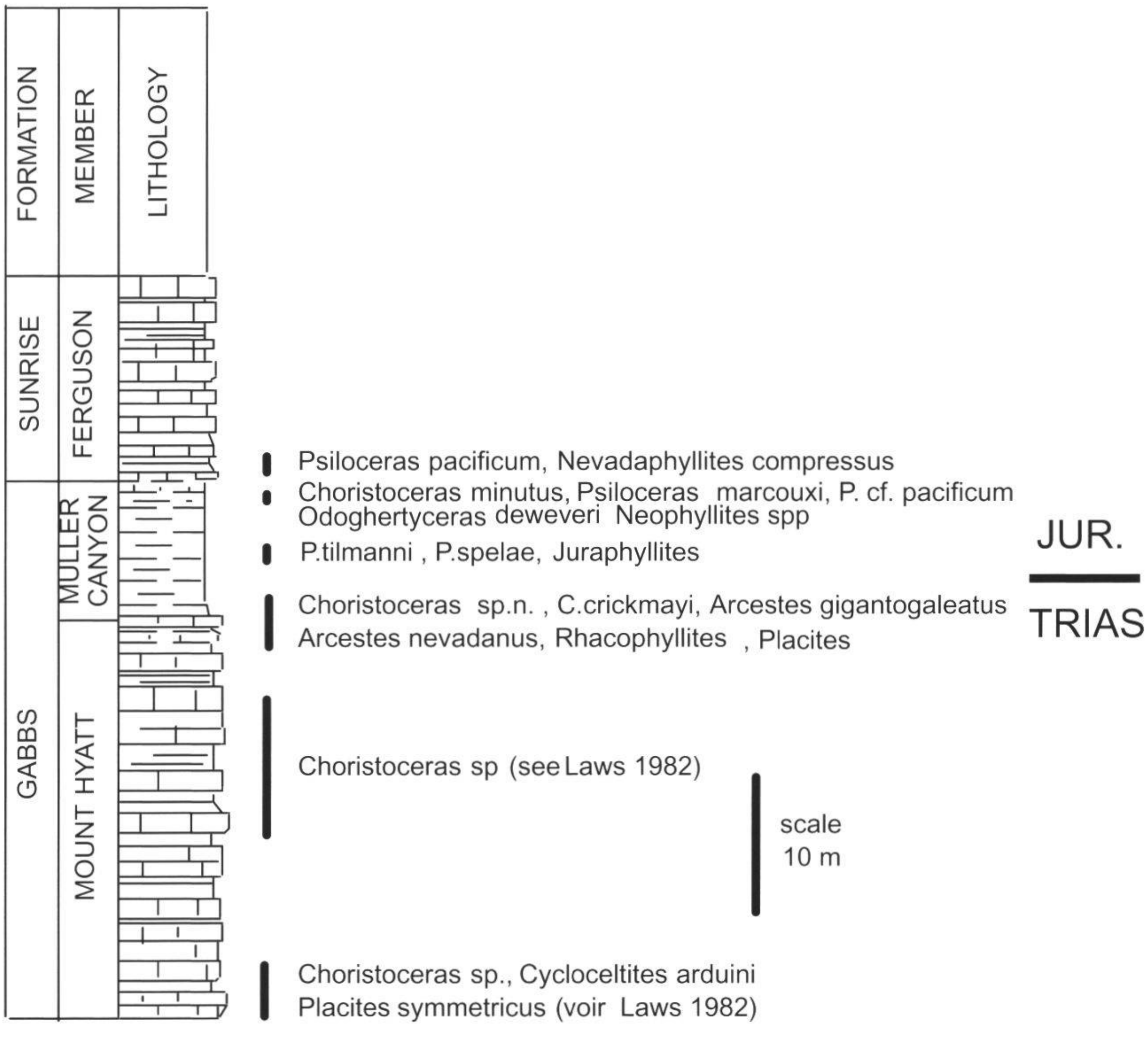

Figure 1.–Summary of the stratigraphic distribution of the ammonites around the Triassic-Jurassic Boundary in the New York Canyon area.

The goal of the present paper is to describe new material referable to *Neophyllites* from the sections at New York Canyon, a potential stratotype of the Triassic-Jurassic boundary. The presence of such forms allows us to correlate precisely between our region and the Euro-boreal and Tethyan sections where the lower Hettangian is well represented. These *Neophyllites* were collected from the *C. minutus-O. deweveri* beds.

Palaeontology

Four crushed specimens were collected in sections 2 (bed L-20) and 6 (bed M-3) described by Guex (1995; see also Guex 1982, Guex et al. 1998 and Taylor & Guex 2000, 2001). They are described below. Suture lines of our specimens are unfortunately not preserved. However we show that from purely morphological and biometrical points of view, that they can be referred to *Neophyllites* with reasonable confidence (see Fig. 3).

Neophyllites aff. *biptychus* Lange (Fig. 2c)

1941 *N. biptychus* n.sp. Lange, Pl.II fig.1
1941 *N. biptychus* intermedius n.subsp. Lange, Pl.II. fig.2

Description

Our specimen is complete and small. Its coiling is evolute and it shows straight, rectiradiate to prorsiradiate, irregularly bifurcated ribs.

Biometric data compiled from Lange's (1941) measurements show that the complete specimen lies well within the range of variability of *Neophyllites* from Germany.

Neophyllites sp. A (Fig. 2a and b)

1982 *Psiloceras* indet. Guex Pl. I, fig. 7-8

Description

Under this informal name we group two specimens showing narrow body chambers, but which are slightly different in their respective ornamentation. Specimen of fig. 2a shows finely ribbed whorls in the umbilical part of the section and a smooth body chamber, and the second shows weak ribbing on the body chamber (Fig. 2b).

Biometric data compiled from Lange's (1941) measurements, show also that the specimens lie well within the range of variability of the German *Neophyllites*.

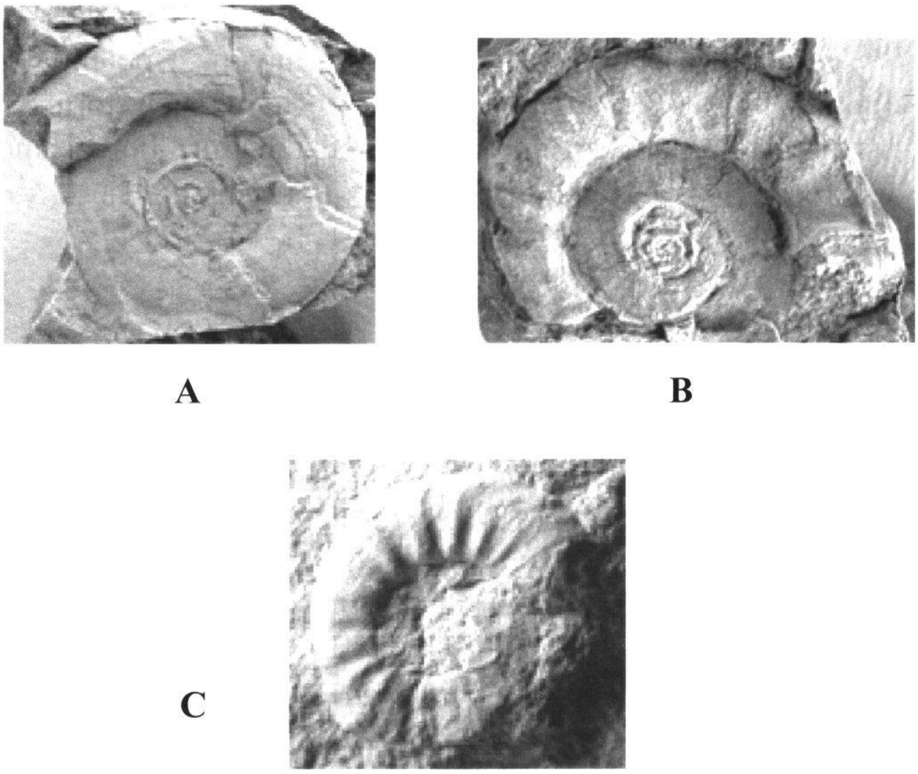

Figure 2.–A) *Neophyllites* sp. A. From New York Canyon, Section 2, bed L-20. D=39 mm; O=17.5 mm; H=11 mm; B) *Neophyllites* sp.A. From New York Canyon, Section 6, bed M-3. D=39 mm; O=19.5 mm; H=10.7 mm; C) *Neophyllites* aff. *biptychus*. From New York Canyon, Section 2, bed L-20. D=15 mm; O=7.7 mm; H=4.8 mm.

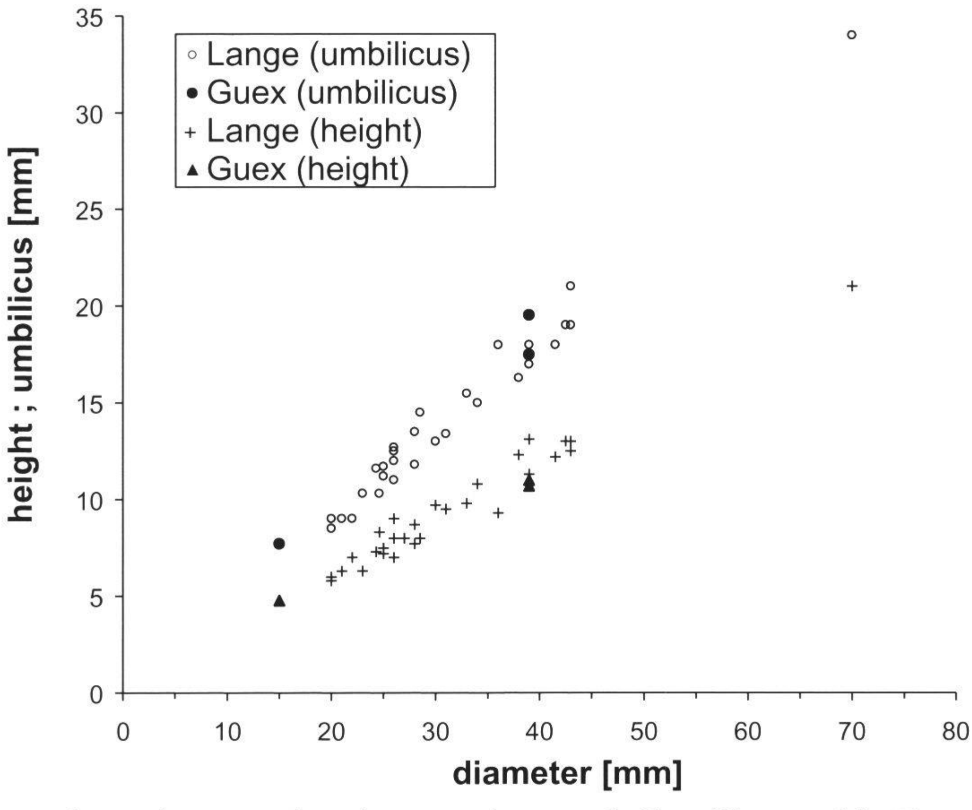

Figure 3.–Biometric comparison between the *Neophyllites* illustrated in Figure 2 and LANGE's (1941) data.

CORRELATION WITH THE BIOSTRATIGRAPHIC DATA FROM NW EUROPE

BLOOS (1999) and BLOOS and PAGE (2000) published fundamental results on the distribution of the Hettangian psiloceratids from England and Germany, demonstrating that the oldest representative of this group belongs to *Psiloceras erugatum* and to various species of the genus *Neophyllites*. These forms are clearly older than the *P. planorbis* and *P. psilonotum* group.
Neophyllites described in the present paper are also older than the first abundant *Psiloceras* from Nevada belonging to the *P. pacificum* group and it seems reasonable to correlate these levels with the NW European *Neophyllites* beds. However, our data prove that the oldest *Psiloceras* (i.e. *P. spelae* and the first representative of *P. tilmanni*) occur at a much lower stratigraphic level, located about 6 meters below the beds with *Choristoceras minutus* and *Odoghertyceras*. The equivalent beds in Europe are entirely lacking in ammonoids.

THE NEGATIVE $\delta^{13}C$ EXCURSIONS IN EUROPE AND CANADA

HESSELBO *et al.* (2002) suggested that the $\delta^{13}C$ negative anomaly reported from Queen Charlotte Island (WARD *et al.* 2001), Hungary (PALFY *et al.* 2001) and England (HESSELBO *et al.* 2002) could be used as marker for the Triassic-Jurassic boundary. However, the Hungarian occurrence is within the range of the conodont *Misikella*, and several meters below the disappearance of a rhaetian *Rhacophyllites* (identified as *Psiloceras*? in PALFY *et al.* 2000 and 2001) and the English occurrence is below the local extinction of conodonts (Hesselbo et al. 2002, Fig. 2 and 4). According to SWIFT (1989) and WARRINGTON *and al.* (1994) these conodonts are found in several localities and are clearly not reworked. We note that everywhere in the world, conodonts disappear before the first appearance of *Psiloceras* and are diagnostic of triassic sediments. In other words we believe that these two negative anomalies are located below the Triassic-Jurassic boundary in these 2 regions. In Canada (Kennecott Point, Queen Charlotte Islands, British Colombia), the radiolarian extinction is located in a 20 meter thick interval barren of ammonites between the local disappearance of *Choristoceras rhaeticum* and the local appearance of *Psiloceras pacificum*, while the negative shift of $\delta^{13}C$ values occurs above the last Triassic radiolarians and is concomitant with the first appearance of abundant jurassic radiolarians. This is a very large faunal gap compared to the sequence in the New York Canyon. In the Queen Charlotte Islands the upper part of the Triassic Crickmayi Zone and basal Jurassic Spelae and Minutus Zones are lacking (TAYLOR and GUEX 2001 and 2002). In this area, the abrupt extinction of Triassic radiolarians is immediately followed by the appearance of a diversified Jurassic radiolarian fauna. This suggests that there is a stratigraphic gap separating the two events in the Queen Charlottes Islands sequences. This conclusion is partly supported by the fact that the radiolarian extinction event is concomitant of the last local occurrence of the late (but not latest) Triassic *Norigondolella* on Kunga Island (PALFY *et al*. 2000, p. 41, Fig. 2).

In the St Audrie's Bay section described by HESSELBO *et al*. (2002), the first negative excursion is followed by low $\delta^{13}C$ values throughout the Planorbis Zone. In Hungary, that negative excursion is immediately followed by a "return" to background values. Therefore, we believe that the $\delta^{13}C$ negative excursions observed in Hungary, England and QCI are not synchronous and cannot be used to define the Triassic-Jurassic boundary (see Fig. 4).

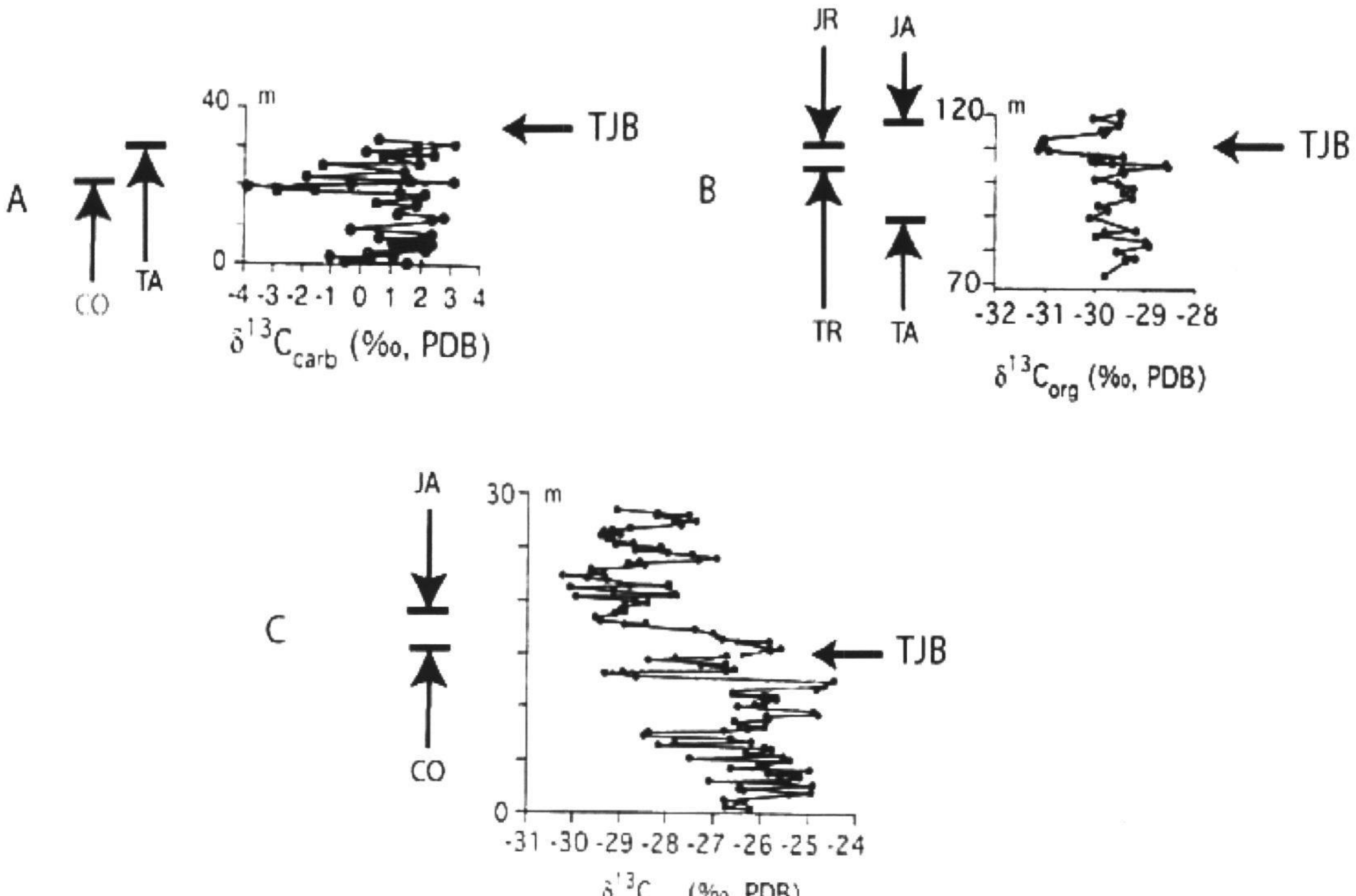

Figure 4.–Curves showing the $\delta^{13}C$ variations in Hungary (section A=Csovar), Western Canada (section B=Kennecott Point) and England (section C=St Audrie's Bay) and position of the Triassic Jurassic boundary (TJB) in these sections. TA=Triassic Ammonoids. JA=Jurassic Ammonites. TR=Triassic Radiolarians. JR=Jurassic Radiolarians. CO=Triassic conodonts.

Table 1.–Triassic-Jurassic boundary ammonite sequences in NE Russia, Nevada, Andes, British Columbia, NW-Europe and Tethys.

	NEVADA (Guex et al., 1998)	NE RUSSIA (Polubotko & Repin, 1983)	ANDES (Hillebrandt, 2000)	BRITISH COLUMBIA (Tipper & Guex, 1994) (Ward & al. 2001)	NW EUROPE (Bloos & Page, 2000)	TETHYS (Krystyn, 1987)
Hettangian	Kammerkarites spp	Pleuropsiloceras Kammerkarites primulus	Kammerkarites	Kammerkarites	Kammerkarites	Kammerkarites
	Psilo. polymorphum	No ammonites	Psilo. rectocostatum Psilo. primocostatum	Psilo. primocostatum	Caloceras Psilo. plicatulum	?
	Psilo. pacificum Nevadaphyllites		Psilo. tilmanni	Psilo. pacificum ?	Psilo. sampsoni Psilo. planorbis	Psilo. calliphyllum
	Choristo. minutus Psilo. tilmanni Psilo. marcouxi Odoghertyceras Neophyllites		Psilo. tilmanni Odoghertyceras	No ammonites	Neophyllites Psilo. erugatum ? No ammonites	?
	Psilo. tilmanni Psilo. spelae Rhacophyllites		No ammonites			
Rhaetian	Choristo. crickmayi Arcestes spp Placites Rhacophyllites		Choristo. cf marshi Choristo. cf crickmayi	Choristo. spp		Choristo. marshi
	Choristo. spp abundant		Choristo. nobile			

Conclusion

The most important characteristics of global stratotype intended to record the boundary between two geological stages obviously reside in the completeness of its sedimentary and biostratigraphic records, and in the occurrence of the fossils having proven chronological value. In the Jurassic, ammonites are usually considered the ideal chronological marker and all high-resolution zonations concerning that period are based on this fossil group. Table 1 demonstrates that the New York Canyon sections provide by far the most complete biochronological sequence known in the world during that interval of time.

The discovery of ammonites belonging to the European *Neophyllites* provides a better correlation between our North American region and the classical NW European sections. Of course, the absence of Triassic ammonoids in the latter region precludes the possibility of defining the stratotype for the Triassic-Jurassic boundary there. The Rhaetian age of the negative $\delta^{13}C$ anomalies discovered in Europe also preclude a definition of the boundary between the two systems based on the carbon isotope curves.

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Erratum: in Figure 9 of the paper of Taylor and Guex (2002, p. 12) there are two spelling mistakes. Please read *Pleuronautilus* instead of *Pleuroacanthites* and *Juraphyllites* (s.l.) instead of *J.* (s.l.).

References

Bloos G. and Page K., 2000. The basal Jurassic ammonite succession in the North West European Province – review and new results. *GeoResearch Forum 6*: 27-40.

Bloos G., 1999. *Neophyllites* (*Ammonoidea, Psiloceratidae*) in the earliest Jurassic of South Germany. *N. Jb. Geol. Paläont. Abh.211*: 7-29.

Guex J., 1982. Relation entre le genre *Psiloceras* et les *Phylloceratida* au voisinage de la limite Trias-Jurassique. *Bull. Géol. Lausanne 260*: 47-52.

Guex J., 1995. Ammonites hettangiennes de la Gabbs Valley Range (Nevada). *Mémoires de Géologie, Lausanne 27:* 1-130.

Guex J., Taylor D., Rakus M. et Bucher H., 1998. Deux nouveaux genres et quatre nouvelles espèces d'ammonites (*Cephalopoda*) du Lias inférieur. *Bull. Géol. Lausanne 339:* 73-85.

Hesselbo S.P., Robinson S.A., Surlyk F. and Piasecki S., 2002. Terrestrial and marine exitnction at the Triassic-Jurassic boundary synchronized with major carbon-cycle perturbation: A link to initiation of massive volcanism? *Geology 30*: 251-254.

Hillebrandt A. v., 2000. Die Ammonitenfauna des südamerikanischen Hettangium, Teil III. *Palaeontographica Abt. A 258*: 65-116.

Krystyn L., 1987. Zur Rhaet-Stratigraphie in den Zlambach-Schichten. *Oesterr. Akad. Wiss.Math.-naturkw. Kl. Abt.1, 196*: 21-36.

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

PALFY J. and DOSZTALY L., 2000. A New Marine Triassic-Jurassic Boundary section in Hungary. *GeoResearch Forum 6*: 173-180.

PALFY J., DEMENY A., HAAS J., HETENY M., ORCHARD M.J. and VETO I., 2001. Carbon Isotope anomaly and other geochemical chanes at the Triassic Jurassic boundary from a marine section in Hungary. *Geology 29*: 1047-1050.

PALFY J., MORTENSEN J.K., CARTER E.S., SMITH P.L., FRIEDMAN R.M. and TIPPER H.W., 2000. Timing of the end-Triassic mass extinction: first on land than in the sea? *Geology 28*: 39-42.

POLUBOTKO I.V. and REPIN Y.S., 1983. Identification of a new ammonite zone at the base of the Jurassic System. *Dokl. Akad. Nauk S.S.S.R. 261/6*: 1394-1398.

SWIFT A., 1989. First record of conodonts from the late Triassic of Britain. *Paleontology* 32: 325-333.

TAYLOR D., GUEX J. and RAKUS M., 2001. Hettangian and Sinemurian Ammonoid Zonation for the western Cordillera of North America. *Bull. Géol. Lausanne 350:* 381-421.

TAYLOR D. and GUEX J., 2002. The Triassic-Jurassic system boundary in the John Day Inlier, East-Central Oregon. *Oregon Geology 64/1*: 3-28.

TIPPER H.W. and GUEX J., 1994. Preliminary remarks on the Hettangian ammonite succession in Queen Charlotte Island, British Columbia. *Geobios 17*: 477-483.

WARD P.D., HAGGAR J.W., CARTER E.S., WILBUR D., TIPPER H.W. and EVANS T., 2001. Sudden productivity collapse associated with the Triassic-Jurassic boundary mass extinction. *Science 292*: 1148-1150.

WARRINGTON G., COPE J.C.W. and IVIMEY-COOK H.C., 1994. St Audrie's Bay, Somerset, England: a candidate Global Stratotype Section and Point for the base of the Jurassic System. *Geol. Mag. 131.2*: 191-200.

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