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Larger benthic foraminifera and microfacies of Eocene limestone boulders reworked in the Miocene of the Eastern Alps (Austria)

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3 Text-Figures

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Northwestern Tethys
Priabonian
Larger Benthic Foraminifera
Microfacies
Biostratigraphy

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Abstract

Miocene deposits near Wimpassing an der Leitha (Burgenland) and Kirchberg am Wechsel (Lower Austria) contain components of Eocene shallow water limestone. Thin sections of the Wimpassing samples can be assigned to coralline algal debris facies. Occurrences of the benthic foraminifera species *Asterigerina rotula* (KAUFMANN), *N. chavannesi* DE LA HARPE, *N. pulchellus* HANTKEN, *N. incrassatus ramondiformis* DE LA HARPE and *Borelis vonderschmitti* (SCHWEIGHAUSER) give evidence for the Priabonian Shallow Benthic Zones SBZ 19 and SBZ 20. The samples from Kirchberg can be attributed to the orthophragminid facies, abundant orthophragminid specimens occur but species determination was attempted on one specimen only.

Großforaminiferen und Mikrofazies umgelagerter Eozänkalke im ostalpinen Miozän (Österreich)

Zusammenfassung

Miozäne Ablagerungen bei Wimpassing an der Leitha (Burgenland) und Kirchberg am Wechsel (Niederösterreich) enthalten Blöcke von eozänen Flachwasserkalken. In Dünnschliffen der Wimpassinger Proben konnten die benthischen Großforaminiferenarten *Asterigerina rotula* (KAUFMANN), *N. chavannesi* DE LA HARPE, *N. pulchellus* HANTKEN, *N. incrassatus ramondiformis* DE LA HARPE und *Borelis vonderschmitti* (SCHWEIGHAUSER) nachgewiesen werden, welche die priabonen Benthoszonen SBZ 19 bis SBZ 20 belegen. In den Dünnschliffen der Kirchberg-Proben treten massenhaft Discocyclinen auf, die aber artlich nur schwierig bestimmt werden konnten.

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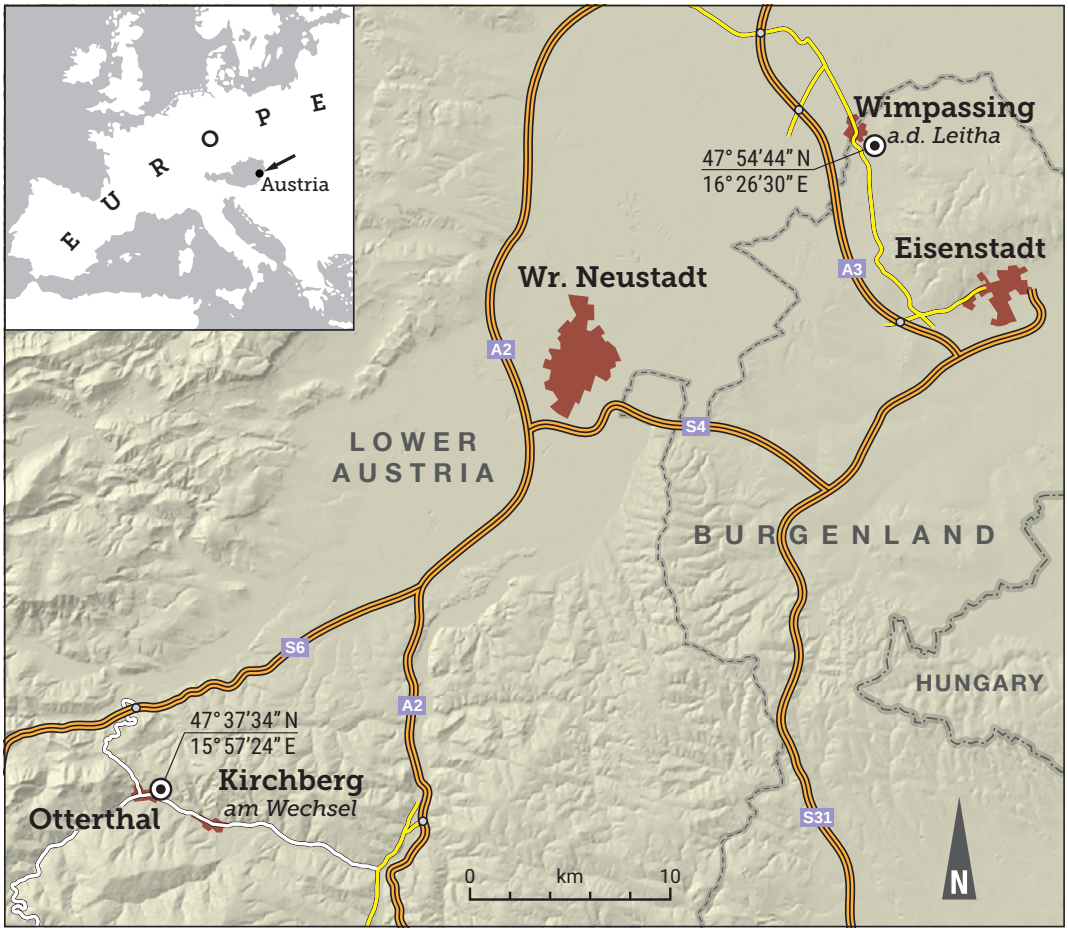
Introduction

In the Priabonian and early Oligocene, an extensive shallow water platform existed in the area of what would later be the Eastern Alps (RÖGL, 1999). Due to subsequent erosion, only small remnants of the platform deposits are preserved in situ (see EGGER et al., 2017, and references therein). However, abundant reworked pebbles of these rocks were recognized in upper Oligocene and Miocene Molasse deposits in Bavaria (MOUSSAVIAN, 1984; HAGN, 1989) and are known since long from two Miocene outcrops (Text-Fig. 1) at the eastern rim of the Eastern Alps (TOULA, 1879; MOHR, 1910). These boulders enclosed within Miocene conglomerates in Lower Austria (Otterthal near Kirchberg am Wechsel) and Burgenland (Wimpassing an der Leitha) were originally assigned to the Lutetian (TRAUTH, 1918). PAPP (1958) studied the same thin sections and attributed them to the upper Eocene based on the presence of *Nummulites variolarius* LAMARCK. KRAMER (1962) reported on *Nummulites variolarius* LAMARCK and *Discocyclina augustae* (VAN DER WEIJDEN) from Kirchberg and also considered them to be upper Eocene. The species *N. variolarius* was suggested to be the ancestor of *N. incrassatus* (DE LA HARPE) at the base of the upper Eocene and both species occur throughout the whole Priabonian (HERB & HEKEL, 1973). PAPAZZONI & SIROTTI (1995) recognized the Biozone *Nummulites variolarius/incrassatus* to be close to the Bartonian/Priabonian boundary. For this paper, we have re-sampled these localities to document both, microfacies and larger benthic foraminifera (LBF) assemblages, which we correlated to the Shallow Benthic Zones (SBZ) of SERRA-KIEL et al. (1998).

Material and Methods

At Otterthal near Kirchberg am Wechsel Eocene limestone boulders occur in debris flow layers of a Miocene alluvial fan (EBNER et al., 1991). It can be assumed that the boulders in the Miocene at Wimpassing an der Leitha were deposited in a similar environment. The co-occurrence of Eocene limestone and metamorphic rocks of the Wechsel unit suggests a transgressional contact between the Eocene and the crystalline basement. For a better assessment of the age of this transgression, thin sections of the Eocene components were prepared at the laboratory of the Geological Survey of Austria for the taxonomic determination of larger benthic foraminifera specimens. The identification at specific level of the larger benthic foraminiferas (orthophragminids and nummulitids) was done whenever an oriented cut allowed the measurements of the relevant biometric parameters. Stratigraphic ranges of larger benthic foraminifera were determined using the Shallow Benthic Zonation (SBZ) of SERRA-KIEL et al. (1998). Microfacies analysis of the thin sections show a diverse fossil assemblage that consists mostly of fragmented coralline algae and LBF. Also present are smaller benthic foraminifera (rotaliids, textulariids and miliolids), bryozoans as well as corals, echinoderms and mollusks fragments. The microfacies of the studies samples were identified based on the Major Facies Type (MTF) classification of NEBELSICK et al. (2005).



Text-Fig. 1.
Position of sample locations in Lower Austria and Burgenland.

Microfacies and Biostratigraphy

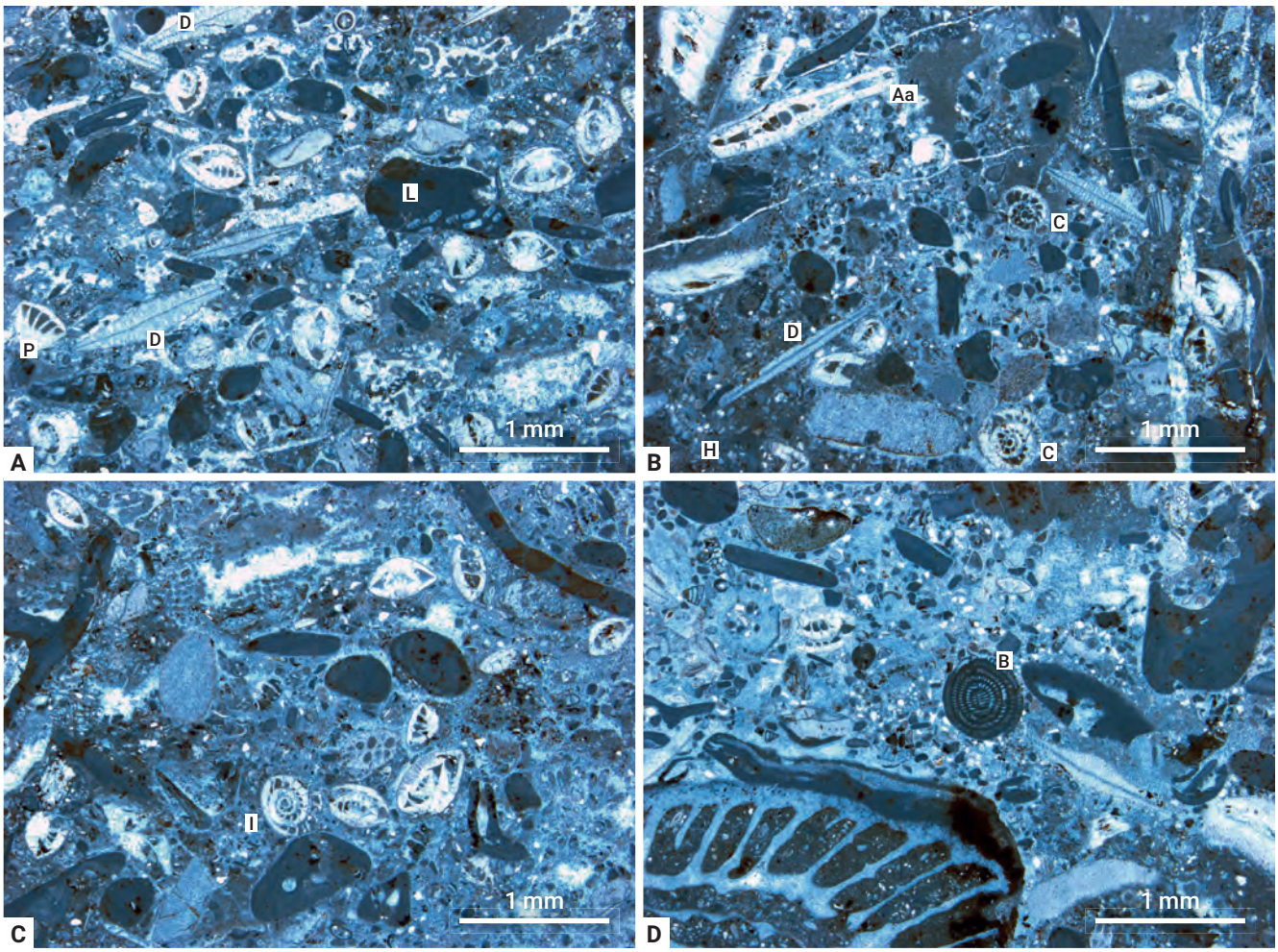
Wimpassing an der Leitha

The brownish red limestone is a wackestone to floatstone and rich in coralline algal debris and benthic foraminifers (Text-Fig. 2). The algal fragments are up to 5 mm long and predominantly consist of non-geniculate corallines, possibly belonging to the genus *Lithothamnion.* The dominating foraminifera species is *Asterigerina rotula* (KAUFMANN) showing rounded, thick walled tests ranging in diameter from 0.7 to 1 mm. The LBF assemblage consists of fragmented orthophragminids (mainly discocyclinids) and few nummulitids (i.e., radiate nummulitids and operculinids). The discocyclinid tests are up to 5 mm in size but no species could be identified since equatorial sections through the nepionts was available. Discocyclinids tests are mostly well preserved and do not display major evidences of transportations and erosion, whilst all other foraminifera shows evident signs of different types of reworking. Among the nummulitids it is possible to identify species belonging to *N. chavannesi* DE LA HARPE, *N. pulchellus* HANTKEN and *N. incrassatus ramondiformis* DE LA HARPE.

Nummulites chavannesi is characterized by relatively small test and considerably large proloculus and these characteristics are rather unique among the upper Eocene nummulite fauna. The proloculus diameter measurements on the two specimens identified (220 and 240 µm) nicely fit with the data published by HERB & HECKEL 1975 and more recently by LESS et al. (2011). The test is slighly smaller than *N. incrassatus* spp., which also has smaller proloculus similarly to *N. cunialensis*. The chronostratigraphic age reported for this taxon is uppermost Bartonian to Priabonian (SBZ 18–20 sensu PAPAZZONI et al., 2017).

Nummulites pulchellus is the only nummulitid taxon with almost straight septa and operculinid coiling in the uppermost Eocene. In the material here available, unfortunately, only a tangential cut is available but the taxonomic identification should be correct. The stratigraphic position is similar to *N. chavannesi*, uppermost Bartonian to Priabonian (SBZ 18–20).

Nummulites incrassatus ramondiformis is characterized by medium sized proloculus between *N. variolarius* and the other subspecies *N. incrassatus incrassatus*. Also the spiral growth in *N. incrassatus ramondiformis* is diagnostic as it grows relatively slower than *N. incrassatus incrassatus*. The diameter measured in the available sections is 186 µm, which perfectly fits with the biometric data published by HERB & HECKEL (1973, 1975) as well as its spiral growth. The stratigraphic range of this taxon is reported as SBZ 19–20 by SERRA KIEL et al. (1998) and therefore restricted to the middle to uppermost Priabonian (PAPAZZONI et al., 2017).



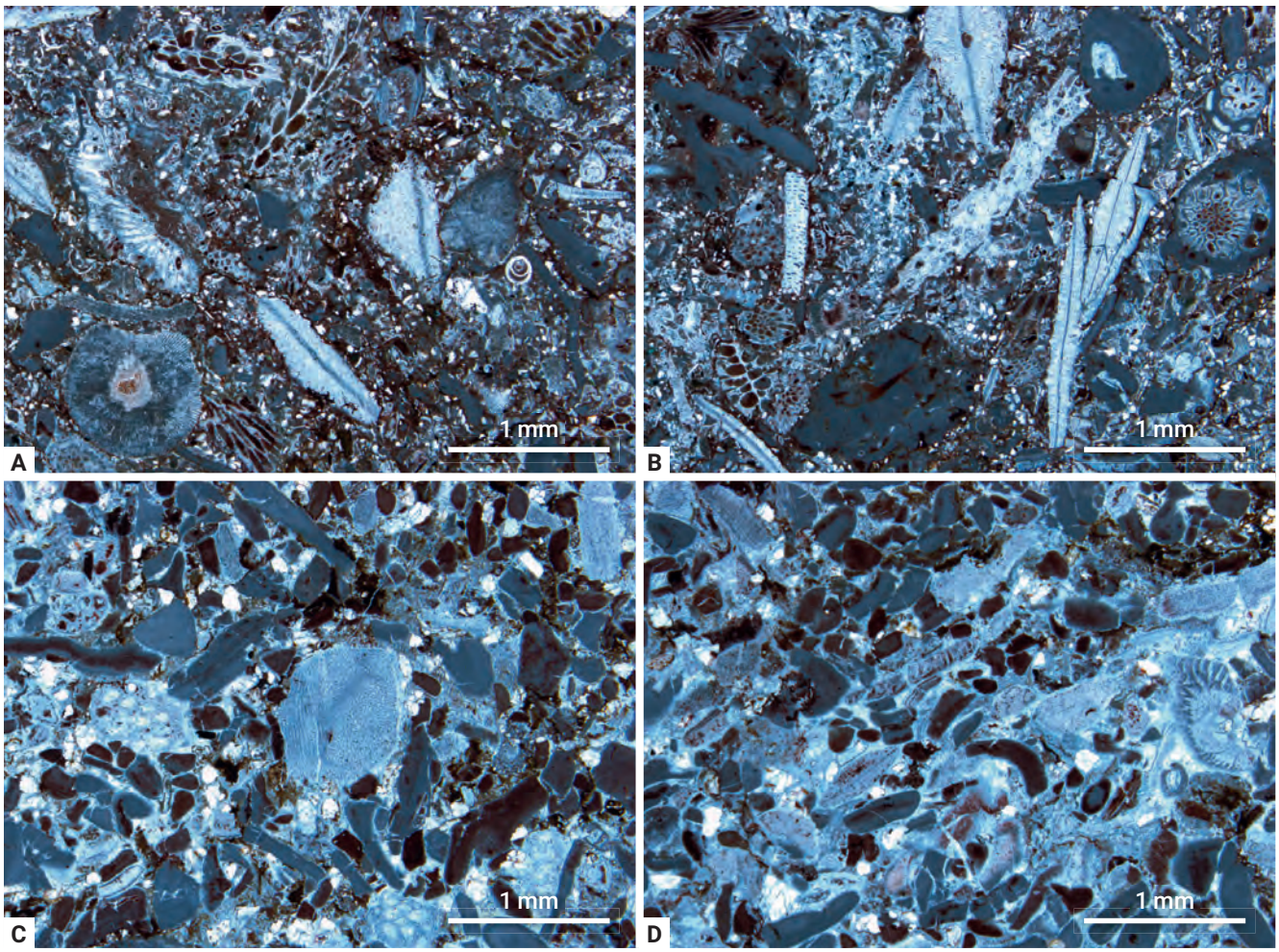
Text-Fig. 2.
Thin-section images of Priabonian limestone from Wimpassing: L: *Lithothamnium* sp., P: *Nummulites pulchellus*, D: *Discocyclina* sp., A: *Asterigerina rotula*, C: *Nummulites chavannesi*, H: *Halkyardia minima*, Aa: *Assilina* ex gr. *alpina*, B: *Borelis vonderschmitti*, I: *N. incrassatus ramondiformis*.

Three more forms have been identified and are age diagnostic: one specimen of *Borelis vonderschmitti* (SCHWEIGHAUSER), one specimen of *Halkyardia minima* LIEBUS and one specimen of *Assilina* ex. gr. *alpina*. These taxa do not restrict the stratigraphic range already given by the aforementioned nummulitids. Additionally, other small benthic foraminifera, coral fragments, bryozoan, mollusc fragments and echinoid plates form up to 20 % of the rock.

In the classification of NEBELSICK et al. (2005) this facies can be assigned to Major Facies Type 4 (MFT-4: coralline algal debris facies), which can occur in a wide variety of environmental settings. The larger and thinner orthophragminids and only rare nummulitids indicates stable, quieter water environments in the outer shelf. The presence of coral debris in the sediments could indicate the proximity to a reef structure. PAPP et al. (1970) referred to this facies as *Asterigerina* facies.

Kirchberg am Wechsel

A boulder was collected along the hiking trail between Otterthal and Goldberg. The light red limestone is a wackestone to floatstone and characterized by thin, disc-shaped tests of orthophragminids, coralline algal crusts and high numbers of erected bryozoans, which together form up to 60 % of the rock (Text-Fig. 3). Orthophragminids are represented by densely packed specimens of *Discocyclina* sp. and rare *Orbitoclypeus* sp. Species determination was not easily possible due to the lack of orientated cuts; the only specimen where a tangential section of a Discocyclina's nepiont is visible seems to point to a *Discocyclina dispansa umbilicata* (DEPRAT) as proloculus diameter is 270 µm, deuteroloculus diameter is 540 µm and height and width of the equatorial chamberlets after 11 annuli at 0.5 mm are respectively 91 and 55 µm. The stratigraphic range for this taxon covers the entire Priabonian and it is possibly not so different from the already recognized *Discocyclina augustae* WEIJDEN by KRAMER (1962). Nummulitids were not encountered. Additionally, abundant quartz grains, smaller benthic foraminifera (nodosariids, miliolids), very rare planktonic foraminifera (globigerinids) and echinoderm plates occur. This orthophragminid facies is widespread in the upper Eocene of the Tethyan realm. In the classification of NEBELSICK et al. (2005) this facies corresponds to Major Facies Type 8 (MFT-8), which is interpreted to have accumulated under open-shelf conditions. Although *Nummulites variolarius* (LAMARCK) have been reported at Kirchberg by KRAMER (1962), our samples are remarkable due to the absence of nummulitids. This can be interpreted as a progressively deepening of the depositional environment with optimal conditions for the development of large orthophragminids and bryozoans in the deeper part of the photic zone.



Text-Fig. 3.
Thin-section images of Priabonian limestone from Kirchberg: A, B: Large, thin and disc-shaped *Discoyclina* sp. in association with coralline algal debris and bryozoans. C, D: coralline algae debris, orthophragminids and bryozoans.

Conclusions

At both localities, larger benthic foraminiferal assemblages are characterized by relative abundances and low diversity, common genera of the Tethyan realm as *Asterocyclina*, *Pellatispirella*, *Spiroclypeus* and *Heterostegina* seems to be absent. Using LBF, the coralline algal debris facies (MTF-4) can be attributed to the SBZ 19 to 20 (Priabonian). Tentatively, based on the biostratigraphic results of PAPP (1958) and KRAMER (1962) the identified orthophragminids facies (MTF-8) can be assigned to the SBZ 18 to 20 (upper Bartonian–Priabonian). The finding of *N. incrassatus ramondiformis* could restrict the stratigraphy to SBZ 19 and 20 but since this taxon was found in one specimen only, few more data need to be collected to give solid age determinations.

At Kirchberg and Wimpassing, Eocene boulders give evidence for a transgression and marine conditions on internal parts of the Eastern Alps in the Priabonian. In Eocene outcrops in near-by Hungary, the onset of the Eocene transgression is determined as Bartonian (BIGNOT et al., 1985). There, the successive steps of the transgression could be traced, from the first non-marine inundation to normal shallow marine conditions. The latter are documented by deposits containing *Nummulites striatus minor* D'ARCHIAC & HAIME, which is diagnostic for the uppermost Bartonian to basal Priabonian Zones SBZ 18 and SBZ 19 partim. It can be concluded that the same transgression affected the eastern part of the Eastern Alps. In the middle part of the Eastern Alps, the Bartonian transgression was identified at the base of the Inntal Group in the Northern Calcareous Alps (EGGER et al., 2017). Reworked pebbles of Priabonian and Lower Oligocene marine deposits from the Northern Calcareous Alps occur in Miocene formations of the Western Bavarian Molasse (HAGN, 1989). These occurrences indicate marine conditions in large areas of the Northern Calcareous Alps until the early Oligocene. Probably, this transgression was an eustatic sea-level rise and can be assigned to supercycle TA4 in the classification of HAQ et al. (1988).

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