Problems of using marine ostracods for stratigraphic correlation of the northern shelf of the Middle Cretaceous Tethys

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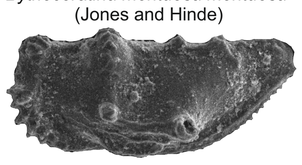
Golcocythere calkeri Bonnema

Cythereis longaeva Pokorny

Cornicythereis larivourensis (Damotte & Grosdidier),

Bythoceratina montuosa montuosa (Jones and Hinde)



500 µm

INTRODUCTION

During the Middle Cretaceous time, the northern margin of the Tethys Ocean with a coastline from the modern British Isles to Tajikistan existed on the territory of Eurasia. Reconstructions of abiotic conditions in the ocean turn out to be favorable for ostracod dispersal, and thus very similar sets of ostracod fossils should be found along the entire oceanic margin. However, the more detailed research shows controversial results. An analysis of the stratigraphic distribution of ostracods shows that long-lived species have a simpler structure and fewer morphological elements. Species with a complex structure have a narrower stratigraphic range. In the deposits of the Middle Cretaceous of Ukraine, it was possible to reliably identify several species of ostracods, which are of high importance for the stratigraphy of Western Europe. I conducted a research and determined that the boreal zone species *Golcocythere calkeri* Bonnema, *Cythereis longaeva* Pokorny were found in Ukraine since the Lower Turonian times, but they were identified for Coniacian and Santonian in the European Basins. Also, species *Cornicythereis larivourensis* (Damotte & Grosdidier), *Homocythere harrisiana* (Jones), that disappeared in the middle Cenomanian in Western Europe, were typical for the Upper Cenomanian in Ukraine. The species *Bythoceratina montuosa montuosa* (Jones and Hinde) were prevalent in the Lower Turonian in Ukraine, however, they were found since the Upper Turonian in Turkmenistan and Western Europe.

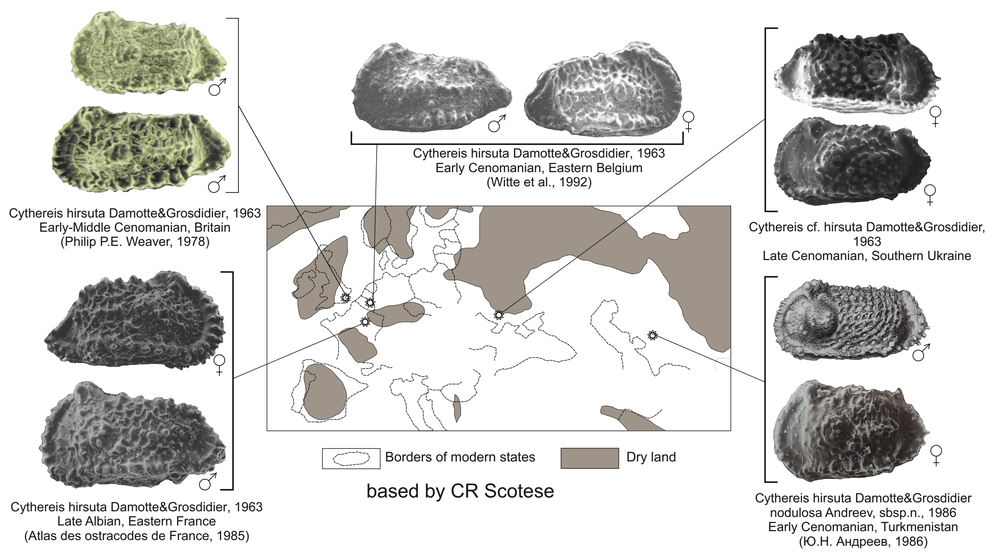
Challenges

The more complex the structure is, the more differences can be found in the description of one species. Difficulties are caused by species variability and geographical variability. Thus, different species or subspecies are often artificially combined into one species. To solve this problem, it is necessary to develop a unified scheme for describing the morphology of ostracods and determine what value a particular morphological element has for the taxonomy. It is also necessary to determine the limits of variability of morphological elements of one species in different habitat conditions.

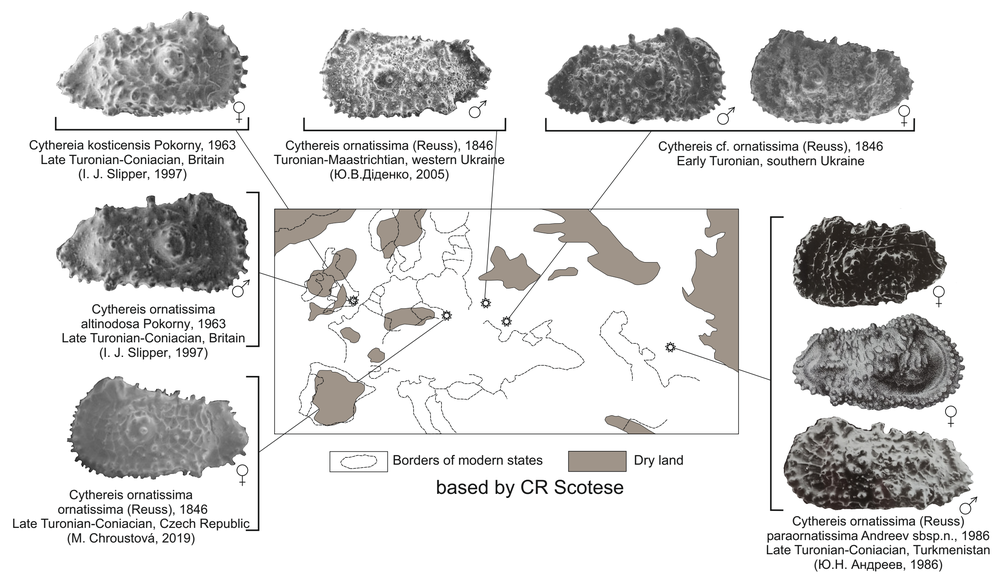
Materials and methods

To find a solution, deposits of the Upper Cenomanian and Lower Turonian of Western Ukraine were studied. About 30 carapaces late Cenomanians species *Cythereis hirsuta?* Damotte&Grosdidier and 50 carapaces Turonians species *Cythereis ornatissima?* (Reuss) were discovered. Each of these species was studied under conditions of the upper sublittoral and lower sublittoral. The upper sublittoral is defined by the high dynamics of the aquatic environment, the large number of remains of diverse macrofauna and ostracod **Schulieridea sp**. and **Xestoleberis sp.** The lower sublittoral is defined by calm conditions of deposition of sediments, remains of fragile shells and a large number of ostracods **Pontocyprella sp**., **Macrocypris sp**., **Monoceratina sp**.

DISTRIBUTION OF THE COLLECTIVE SPECIES Cythereis hirsuta Damotte & Grosdidier, 1963
DURING THE LATE ALBIAN-CENOMANIAN



DISTRIBUTION OF THE COLLECTIVE SPECIES Cythereis ornatissima ? (Reuss), 1846
DURING THE TOURONIAN-COGNACIAN



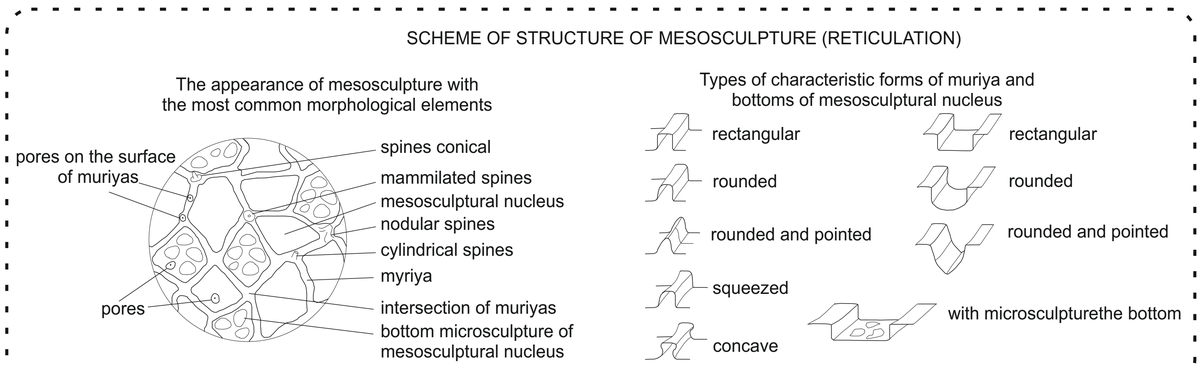
Geographical variability

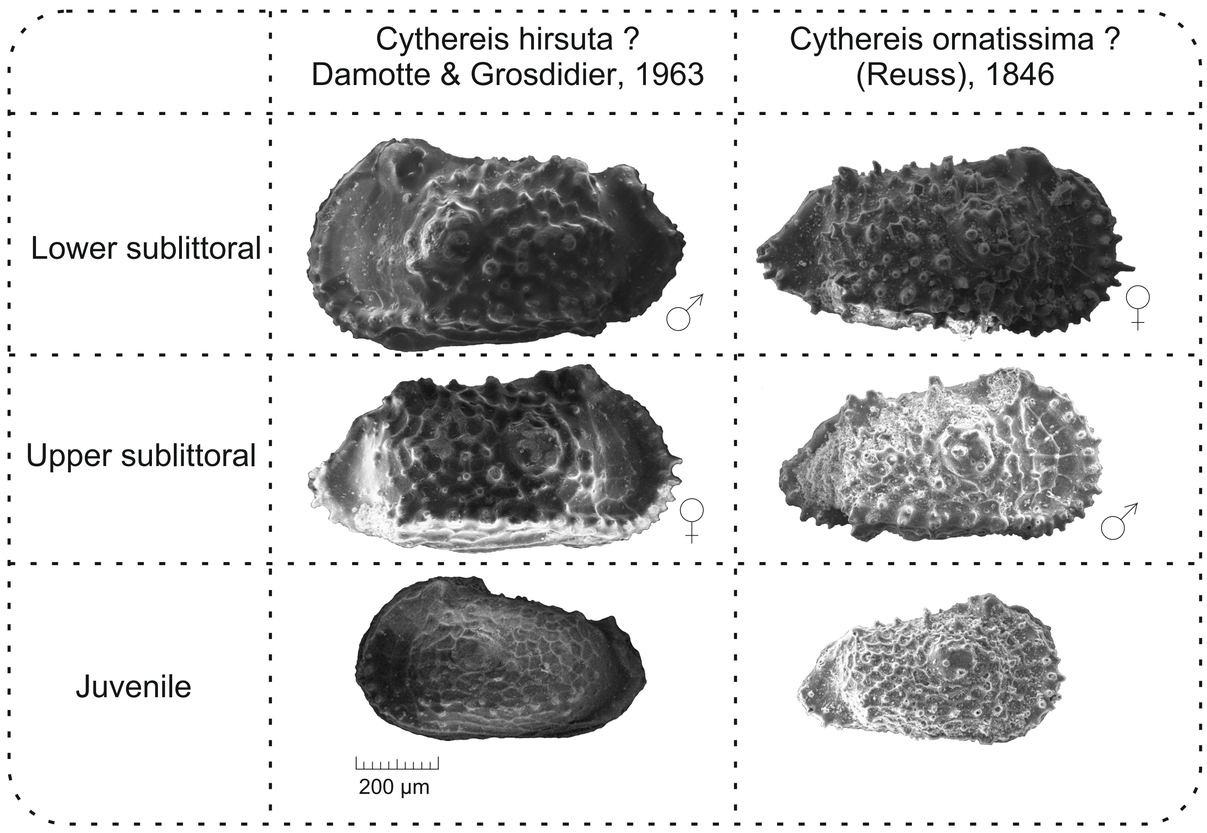
The differences in reticulation, shape of anterior and posterior marginal ribs, posterior cardinal angle, position of greatest height and inflation, shape of ventral and central rib are observed in all shells of *Cythereis hirsuta?* Damotte&Grosdidier and *Cythereis ornatissima?* (Reuss). Particular attention should be paid to the position of inflation and the shape of the ribs, since they are determined by the internal body.

Difference in environmental conditions

In different facies, the first things that change are the reticulation and degree of reticulation. For this, terminology and a way of describing reticulation are proposed. In general terms, with an increase in sea depth and a decrease in near-bottom hydrodynamics, the indicated **Cythereis sp.** get a bigger eye tubercle, the shape of reticulation becomes less regular, the spines become longer and thicker at the base. In the upper sublittoral conditions, the ornamentation is a regular shape of muriya, the spines are short and narrow at the base. Morphological changes correspond to those of Benson, 1975 and Puckett, 1991.

SCHEME OF STRUCTURE OF MESOSCULPTURE (RETICULATION)





Ontogenesis

A qualitative definition of a species is impossible without studying the ontogenesis of species. Juvenile forms are often found in samples. By the number of adults and juveniles, it is possible to make assumptions about habitat conditions and clearly determine the number of species of one genus. During the study of ontogenesis, the constancy of reticulation and the place of its distribution is observed. Also, the morphological elements of the anterior shell margin are more stable.

Phylogenesis and stratigraphy

The species *Cythereis hirsuta?* Damotte&Grosdidier can only be found in the Upper Cenomanian, but *Cythereis ornatissima?* (Reuss) is discovered in the Lower Turonian. Analysis of the ontogenesis of both species suggests that the species *Cythereis ornatissima?* (Reuss) is evolved from *Cythereis hirsuta?* Damotte&Grosdidier. Such a division allows us to accurately identify the phylozone of *Cythereis ornatissima?* (Reuss) and determine the Cenomanian-Turonian boundary on the basis of ostracods for the region of Western Ukraine.

Evolution

At the Cenomanian-Turonian boundary, stable thanatocenosis is observed on the territory of Ukraine, in some places. It indicates stable habitat conditions and the absence of disasters. The described genesis of a new species occurred gradually under stable conditions, which explains such a high level of resemblance between the two species.

CONCLUSION

Before the transgression of the sea, **Cythereis sp.** with box-frame reticulation were widespread in the Upper Cenomanian (which were typical for shallower water conditions). With the development of transgression in the Turonian, **Cythereis sp**. with spinoses ornamentation became widespread (which were typical for deeper water conditions). A large number of Turonian **Cythereis sp**. appeared in different parts of the northern Tethys after the dispersal of the Cenomanian **Cythereis sp.** over long distances. Thus, the wide diversity of *Cythereis ornatissima* (Reuss) is due to the mechanism of anagenesis and gene drift, because closely related parallel phylogenetic lines developed under similar conditions. A wide variety of species similar to *Cythereis ornatissima*? (Reuss) is a problem that can be solved through a detailed study of the ontogenesis of each selected species. The described mechanisms of adaptation also help to solve it.