

JUSTIFICATION OF THE CRETACEOUS AND PALEOGENE BOUNDARY IN THE ZIRABULAK-ZIAETDIN REGION (UZBEKISTAN)

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ABSTRACT

Data are provided on the characteristics of the Cretaceous and Paleogene boundary deposits. The boundary beds of the Cretaceous system (top of the Tym Formation) contain bivalves and foraminifers of Maastrichtian age. In the overlying deposits (Akdzhar and Bukhara formations) bivalves and foraminifera of the Danish, Zealandian and Thanetian stages are common.

Keywords: Paleogene, Maastrichtian, gastropods, rudists, stratigraphic.

INTRODUCTION

The level of the boundary between the Cretaceous and Paleogene has not been sufficiently studied in the Zirabulak-Ziaetdin region. To solve this problem, changes in the taxonomic composition of faunal complexes, as well as changes in the lithological composition of rocks associated with the transformation of facial settings, are of primary importance.

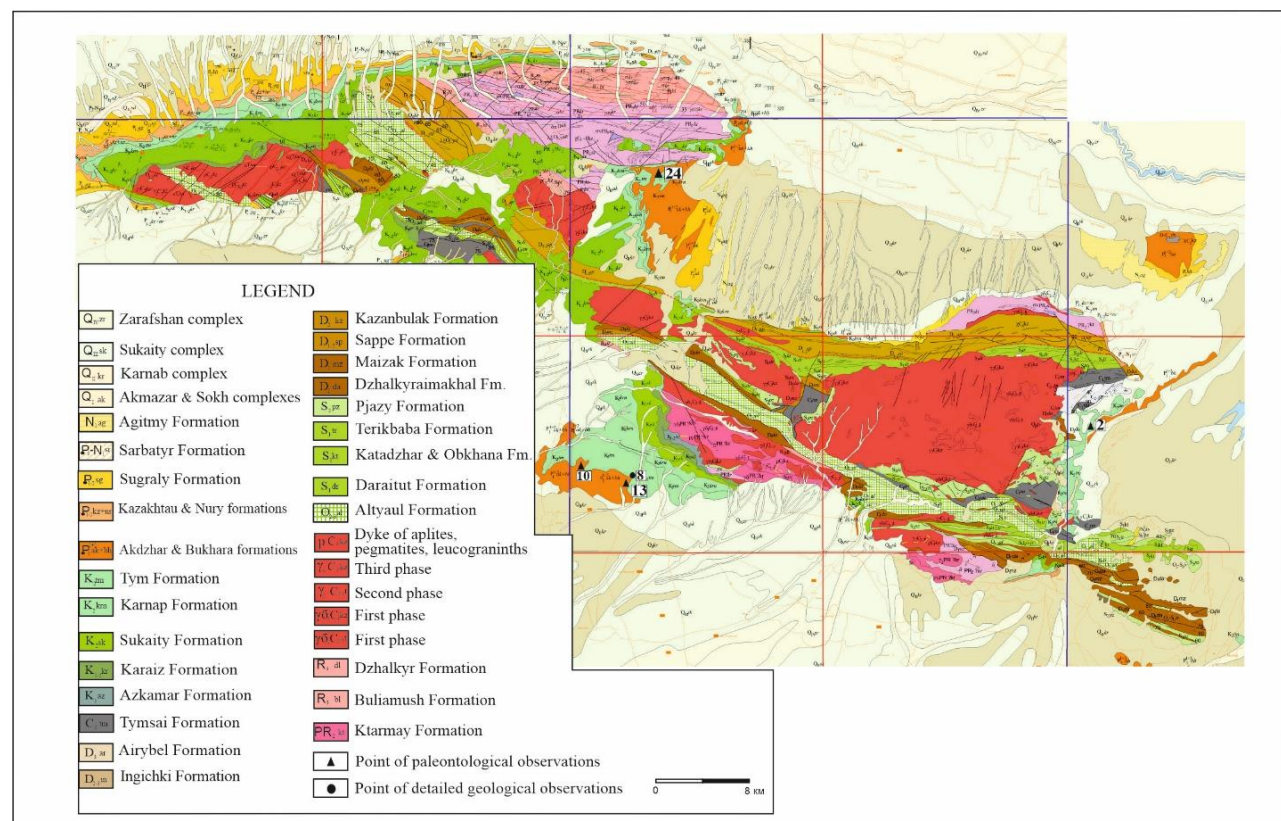


Figure 1: Geological map of the Zirabulak-Ziaetdin region (Khan and Ravshanov, 2006)

In the Cretaceous and Paleogene deposits of the Zirabulak-Ziaetdin region, three reference sections were identified based on stratigraphic completeness, paleontological and facial characteristics, and thickness values. The Auzikarasai section is widespread within the Ziaetdin Mountains, the Kurgancha section is located on the western, north and southwestern slopes of the Zirabulak Mountains, and the Tym section combines deposits located on the southeastern and eastern slopes of the Zirabulak Mountains (Fig. 1).

In these sections, in the Cretaceous and Paleogene boundary interval, the Tym, Akdzhar and Bukhara formations were identified. These formations are characterized by complexes of bivalves and gastropods, which made it possible to correlate them with the divisions of the General Stratigraphic Scale of Uzbekistan (GSS RUz, 2020) and the International Stratigraphic Scale (ISS). Faunal remains from these deposits were identified by I.M. Abduazimova, B. Zhovliev, A. Samiev.

The Tym Formation, which lies in the upper horizons of the Cretaceous was identified by Vyalov (1947, p. 22), named after the Tym Village. The stratotype of the formation is not indicated by the author.

In the Auzikarasai stratotype section, the Tym formation is well exposed and has a wide lateral spread. Its characteristic feature is the predominance of fine-grained yellow, brown, grayish-yellow sands and sandstones in the section. The Tym formation is divided into lower and upper formations. The Lower Tym Formation is composed of gray, greenish-gray, green sands with interlayers of yellowish-red clays in the lower part. In the middle part are grayish-green clays predominate, green with interlayers of sandstones and dark brown, crimson siltstones; in the upper part there is interlayering of variegated grayish-green, red clays and brown sandstones. The thickness of the Lower Tym Formation is 30.0 m. The Tym Formation lies with erosion on the Upper Karnap Formation of the Santonian. No faunal remains were found in the Lower Tym Formation. The Upper Tym Formation consists of grayish-yellow, gray, variegated, calcareous-clayey sandstones, greenish-yellow sands and thin layers of clay. The thickness is 11.0 m. These rocks contain numerous thin-walled oysters - *Liostrea lehmannii* Rom. and forms with a coarser thick wall - *Amphidonta pyrenaica* (Leym.), *Cerastostreon spinosum* (Math.); other bivalves - *Chlamys dujardini* Rom., *Megatrigonia* sp., *Spondylus* sp. and the shells of the right sea urchins - *Cassidulus* sp. At the top of the Upper Tym Formation there are calcareous yellowish gray, light gray sandstones with cores and imprints of rudists - *Gyropleura* sp., *Biradiolites* sp., *Apricardia* sp., *Orbinyana vlasovi* Bobk. In the Shorkuduk section (northeastern slopes of the Ziaetdin Mountains), large rudists - *Apricardia mediasiatatica* Bobk were identified at this stratigraphic level. The complex of bivalve mollusks found in the Tym Formation is spread in Maastrichtian deposits (Karakata Formation) of the Central Kyzylkum (Kuldzhuktau-Auminzatau and Tamdytau types) (Abduazimova, 2022). These are, in particular, the shells of the rudist - *Apricardia mediasiatatica* Bobk., which are characteristic of the Maastrichtian deposits of the southern foothills of South Nuratau mountains, East Kopetdag mountains and the Zeravshan-Hissar mountain region. The wide spreading of rudists - *Apricardia mediasittica* Bobk. and their association with a specific stratigraphic horizon allows to consider this species as an index species for the Upper Cretaceous horizons. Foraminifera - *Reophax* aff. *texanus* Cushman. et Wat., *Haplophrammoides excavatus* Cushman. et Wat., *Ammobaculites* aff. *jetymensis* Tzatz. were identified from the clayey layers of the Upper Tym Formation (definitions by A.M. Bogomolova), developed in the Maastrichtian deposits of the Central Kyzylkum and the southern foothills of South Nuratau mountains.

The Tym Formation is erosive overlain by deposits of the Akdzhar and Bukhara formations. The Akjar Formation was described in the Tajik Depression by K.V. Babkov, G.P. Kreidenkov. The stratotype is located along the Akdzhar Ravine. In the stratotype, the formation is represented by white sugar-like gypsum, oolitic limestones, dolomites with a complex of bivalves and gastropods. Thickness up to 206.0 m (A dictionary of Stratigraphy of Uzbekistan, 2001 pp. 45-46).

In the area of spreading of the Auzikarasai section in the Chingiztau Mountains, the Akdzhar Formation is represented by sandstones, white brecciated calcareous shell rocks with interlayers of marls. The thickness is up to 6.0 m. The Akdzhar Formation lies with erosion on the Tym Formation of the Maastrichtian and contains bivalves - *Barbatia* (Acar) *lamellosa tabulata* Vinc., *Spondylus dutempleanus* (Orb.), *S. faxensis* Lund., *Modiolus jeremejewi* Rom., *M. karabilensis* Vial., *Cardita minutula* Rom., *C. turcomanica* Vial.; gastropods - *Bitium malaise* (Br. et Corn), *Rhinoclavus unisulcatus* (Lam.) (definitions by R.K. Makarova

A.A. Abdusamatov), characteristic of the Lower, Middle Paleocene - Danish, Zealandian stages. In the Ziaetdin section (northeastern foothills of the Ziaetdin Mountains), the Akdzhar formation is represented by white, grayish-white sandstones with interlayers of marls. The thickness is 8.5 m. The Akdzhar formation lies with erosion on the Tysmskaya.

The marls of the Ziaetdin section contain bivalves and gastropods - *Barbatia tennidentata* Hng., *B.praescabra* (Koen.), *Cucullalea* cf. *arcoformis* Neschaev, *C.danica* Ravn, *Lima holzapfeli* Hng., *Spondylus* cf. *dutempleanus* (Orb.) *Modiolus coteae* (Roem.), *Miltha passelequi* (Vine.), *Corbula* (*Cuneocorbula*) *makarova* Abdusam; *Grommium ciptyensis* (Vine.), *Tornatella paresiensis* (Desh.), etc. This complex is typical for the Danish and Zealandian stages of Denmark, Sweden, Belgium and the Akdzhar formation, developed in the Bukhara depression and Central Kyzylkum (Makarova, Abdusamatov, 1987, pp. 82- 85).

Bukhara Formation, identified by O.S. Vyalov in the rank of limestone horizon with *Cuneocorbula*. The stratotype is located near the city of Isfara, Fergana. In the stratotype, the formation is represented by limestones, oolitic, marls, gypsumed sandstones with gypsum interlayers. The thickness is up to 300.0 m. Contains marine bivalves. (Stratigraphic Dictionary of Uzbekistan, 2001. p. 121).

In the Ziaetdin section, the Bukhara Formation conformably overlies the Akdzhar Formation. The Bukhara Formation is composed of strong siliceous, grayish-white limestones. The partial thickness is 2.0 m. The limestones contain bivalves: *Gari edwardsi* Morris, *Cardita minutula* Roem., *Corbula* (*Cuoneocorbula*) *asiatica* Vial.

Bukhara Formation is identified by O.S. Vyalov in the rank of limestone horizon with *Cuneocorbula*. The stratotype is located near the Isfara city, Kyrgyzstan. In the stratotype, the formation is represented by limestones, oolitic, marls, gypsumed sandstones with gypsum interlayers. Thickness is up to 300.0 m. The Bukhara Formation contains sea bivalves (A dictionary of Stratigraphic of Uzbekistan, 2001, p. 121).

In the Auzikarasai key section (western foothills of the Ziaetdin Mountains), the Bukhara Formation overlies the Tym Formation with erosion, and is composed of light gray, finely and medium-layered, sandy limestones (up to 12.0 m thick) with cores and imprints of bivalves and gastropods - *Modiolus jeremejewi* Vial., *Cardita minutula* Rom., *C. aegyptiaca orientalis* Vial., *Lucina lamellicardia* (Cossm.), *Cyrena* (*Corbicula*) *forbesi* Desh., *Pitar similis* (Leym.), *Corbula* (*Cuoneocorbula*) *asiatica* Vial., *Potamides romanovsky* Vial., *Rhinoclavus* sp., *Natica* sp.

In the Shorkuduk section at this stratigraphic level the following species *Lucina gravesi* Desh., *L. prevosti* Desh., *Corbula* (*Cuneocorbula*) *asiatica* Vial., *Cardita bucharensis* Vial., *Gari debilis* Desh., *Tracia prestrashi* Desh., *Mathilda bimorpha* Br.et Corn. (I.M. Abduazimova, A.A. Abdusamatov et al., 2007 f.). The complex of mollusks is similar to the complex found in the Bukhara Formation of the Central Kyzylkum, Fergana Depression, and southern foothills of Southern Nuratau. Most of the species found here are known from the Upper Paleocene, Thanetian Stage of Belgium, France and Denmark. The foraminiferal complex is represented by the following species - *Annectina paleocenica* Suleym., *Lochartia* aff. *luppovi* Bugr., *Triloculina sphaerica* Ser., *Bolivina wilcoxensis* (Cushm.), *Morozovella perclara* (Chal.), *Gaudryina gigantea* (Subb.) (definitions by A.M. Bogomolova), that are common in the Late Paleocene, Thanetian Stage of Uzbekistan and Turkmenistan.

In Chingiztau, the Bukhara Formation consists mainly of white, strong, friable, oolite-like sandstones. The thickness is 5.1 m. The Formation concordantly overlies Akdzhar Formation. In the roof there are dolomitized limestones containing bivalves - *Arca montensis* Cossm., *Glycymeris corneti* (Koen.), *Modiolus jeremejewi* Rom., *M. karabilensis* Vial., *Crassatella korobkovi* Dzbabar., *Cardita bucharensis* Vial., *Lucina prevosti* Desh., *Corbula* (*Cuneocorbula*) *asiatica* Vial., *C. (C.) biangulata* Vial., *Tracia prevosti* Desh.; they are typical in the Late Paleocene-Thanetian. The thickness is 5.0 m.

In the Ziaetdin section, the Bukhara Formation conformably overlies the Akdzhar Formation. The Bukhara Formation is composed of strong siliceous, grayish-white limestones. The partial thickness is 2.0 m. The limestones contain bivalves - *Gari edwardsi* Morris, *Cardita minutula* Roem., *Corbula* (*Cuoneocorbula*) *asiatica* Vial.

More abundant faunal complex from this area is given by A.A. Abdusamatov (I.M. Abduazimova, A.Kh. Abdusamatov, 2007 f). It is represented by species *Astarte netshaevi* Makaz, *Crassatella exelsa* Cossm., *Modiolus jeremjewi* Rom., *M. karbilensis* Vial. *Glycymeris corneti* (Koen.), *Corbula malaisei* (Briar et Cornet) that are common in England, France, Turkmenistan and Uzbekistan.

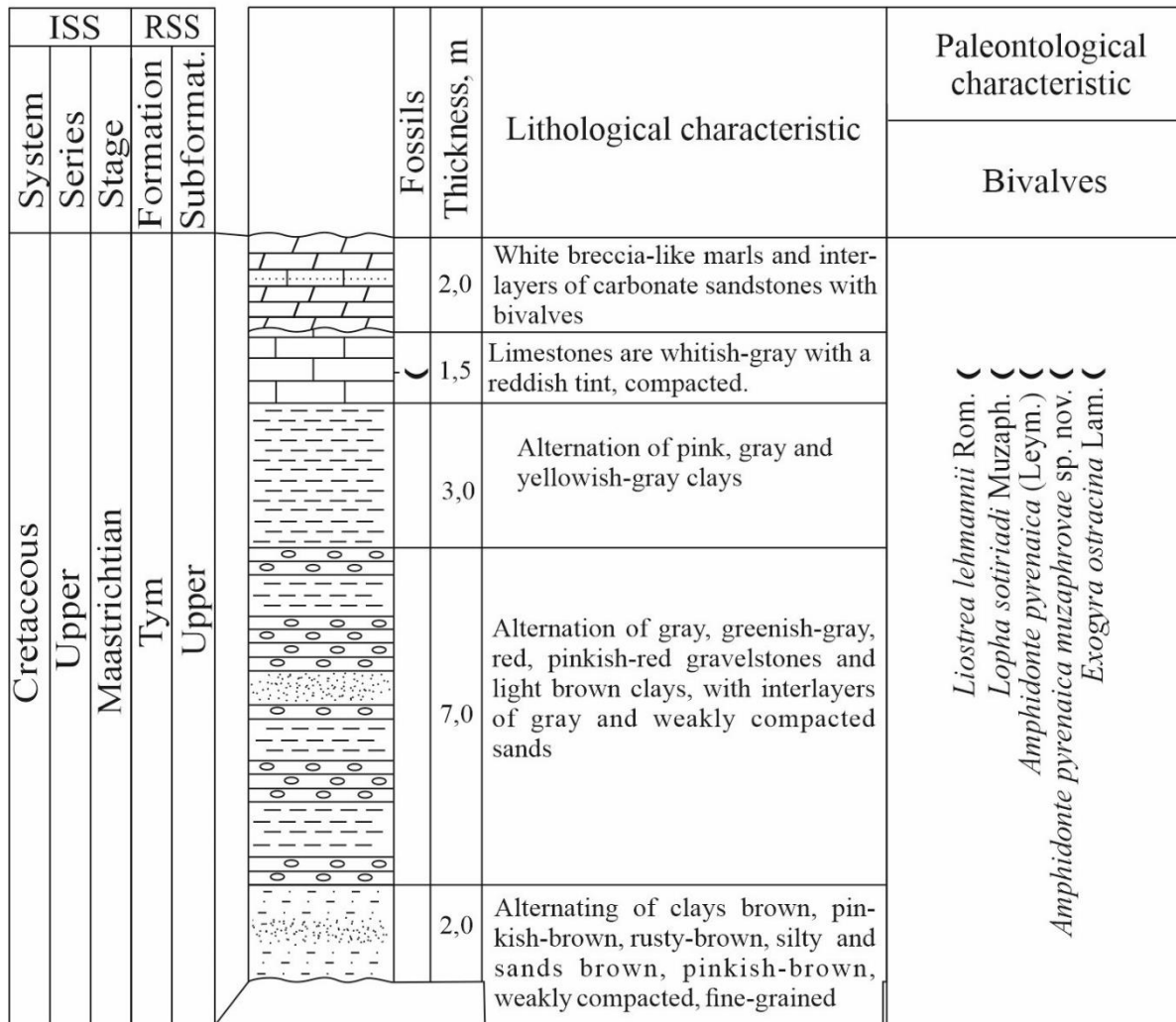


Figure 2: Lithostratigraphy and range of selected bivalves taxa through the Upper Tym Formation in the Tym key section (TIIH-2). Scale 1:200

In the Kurgancha key section, the Lower Tym Formation is composed of greenish-gray, gray sands, gray, greenish-gray clays; grayish-yellow siltstones with gravel grains. The thickness is 25.5 m. It lies with erosion on the Upper Karnap Formation. The Upper Tym Formation in the area of spreading of the key section is most studied to the northwest of the Kurgancha Village (24.0 km) and is represented by calcareous gray, greenish-gray sandstones containing oysters - *Liostrea lehmannii* Rom., *Amphidonte pyrenaica* (Leym.), *Ceratostreon spinosum* (Math.), *Lopha* cf. *sotiriadi* Muzaph; rudists - *Apricardia* cf. *mediasiatica* Bobk., *Gyropleura* cf. *gaurdakensis* Bobk., *Orbignyana* cf. *vlasovi* Bobk., *Praeradiolites* cf. *boucheroni* Bayle et Toucas. The upper part of the Tym Formation section is composed of gray limestones with rudists *Biradiolites* sp. (cf. *boldjuanensis* Bobk.). The faunal complex is characteristic of the Maastrichtian deposits of Uzbekistan and adjacent territories.

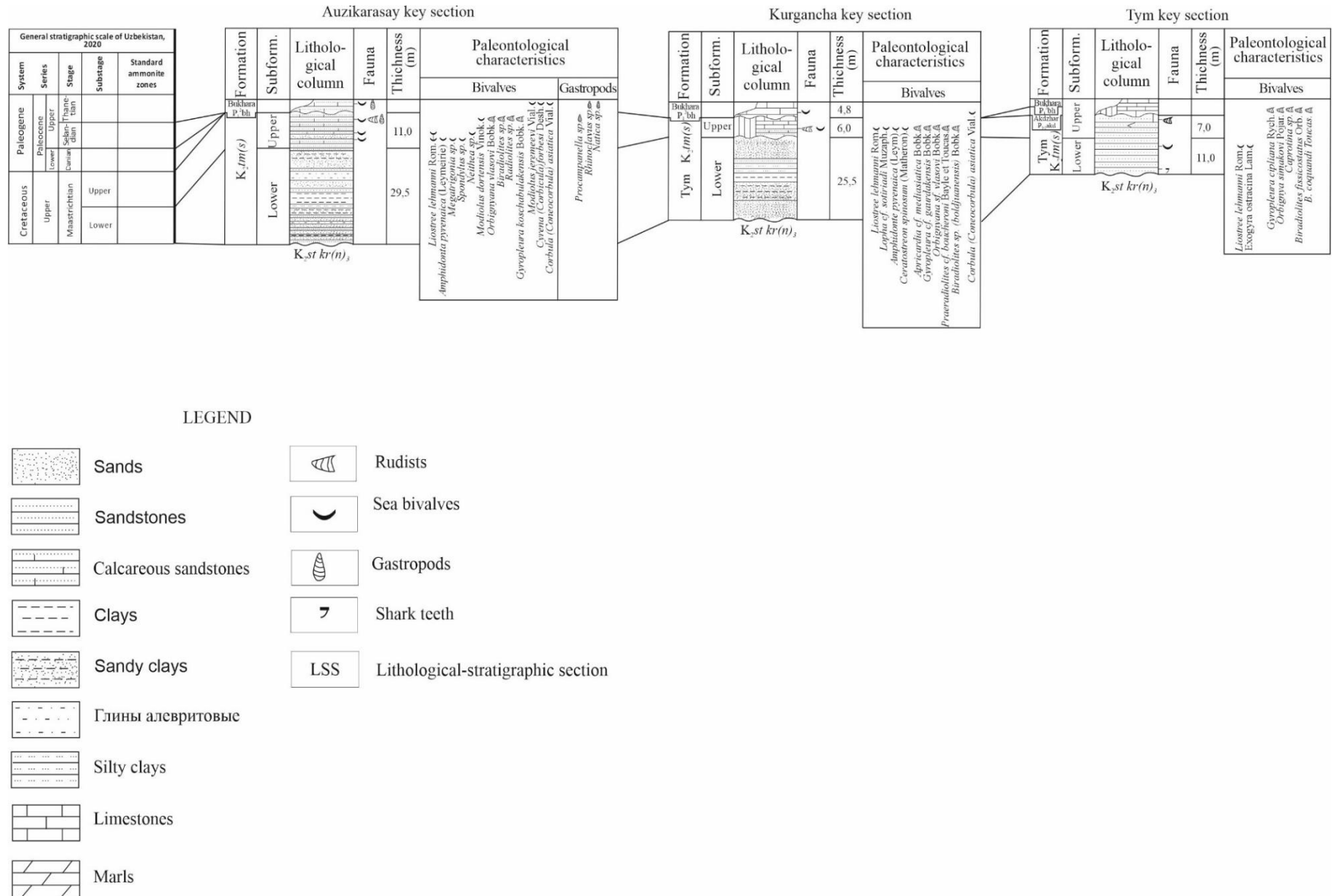


Figure 3: Correlation of sections of Cretaceous and Paleogene deposits of Zirabulak-Zhetda region M:1:1500

Research Article

The Akdzhar Formation spread to the south and west of the Kurgancha Village and lies on the limestones of the Tym Formation with erosion. The Akdzhar Formation is represented by white clays with a thickness of 5.0 m and white limestones (about 2.0 m thick) with traces of faunal remains.

The Bukhara Formation, which lies above, is represented by white, grayish-white, compacted limestones. It conformably overlies the Akdzhar Formation. The limestones are characterized by bivalves - *Glycymeris corneti* (Koenen), *Cardita minutula* Rom., *Pitar duponti* (Cossman), *Corbula* (*Cuneocorbula*) *asiatica* Vial. The complex is characteristic of the Upper Paleocene, Thanetian stage (TPN-10, TDGN-8).

The Bukhara Formation in the Kurgancha type of section lies with erosion on the Tym Formation; it consists of gray, light gray sandstones, harder in the lower part and weakly compacted in the upper. The sandstones contain numerous bivalves - *Modiolus jeremejewi* (Rom.), *Cardita minutula* Rom., *Corbula* (*Cuneocorbula*) *asiatica* Vial. (TPN-24) characteristic of the Upper Paleocene, Thanetian stage.

In the Tym key section, the Lower Tym Formation is characterized by greenish-gray, pinkish-gray sandstones, light gray, banded siltstones. The thickness is 11.0 m. The formation lies with erosion on the Karnap Formation. The Upper

Tym Formation consists of light gray sandy limestones. The thickness is 7.0 m. The limestones contain oysters - *Liostrea lehmannii* Rom., *Exogyra ostracina* Lam., *Lopha sotiriadi* Muzaph., *Amphidonta pyrenaica* (Leym.) (TIIH -2) (Text-fig. 2), characteristic of the Maastrichtian deposits of Uzbekistan and adjacent areas.

The Tym Formation with erosion is overlain by the Bukhara Formation. The latter is represented from bottom to top by white brecciated marls with interlayers of carbonate sandstones including bivalves - *Cardita minutula* (Roem.), *Corbula* (*Cuneocorbula*) *asiatica* Vial. (TIIH-13, sample 13/1), thickness 2.0 m; organogenic-detrital limestones, yellowish-gray, 0.5 m thick; white limestones, weakly compacted with interlayers of yellowish-gray limestones, 3.0 m thick; organic-detrital limestones, 0.5 m thick. The rocks contain bivalves - *Modiolus jeremejewi* (Rom.), *Cardita minutula* (Rom.), *Corbula* (*Cuneocorbula*) *asiatica* Vial., characteristic in the Thanetian Stage. (Text-fig. 3)

The rocks lying above are calcareous, white, medium-grained, weakly compacted sandstones, 1.5 m thick; chemogenic limestones, yellowish-gray, thin and medium-layered, strong, 1.0 m thick; brecciated limestones, thin-layered marls, 3.0 m thick. The total thickness of the Bukhara Formation is 11.5 m.

CONCLUSION

The boundary between the Cretaceous and Paleogene in the Zirabulak-Ziaetdin region is identified at the top of the Tym Formation. In some sections it coincides with the base of the Akdzhar Formation, in others - with the Bukhara Formation. The extinction of the Maastrichtian bivalves and foraminifera community is observed at this level. Bivalves - *Liostrea lehmannii* Rom., *Amphidonta pyrenaica* (Leym.), *Chlamys dujardini* Roem., rudists of the genera *Orbiinyana*, *Biradiolites*, *Apricardia* developed in the Tym Formation suddenly disappear everywhere. Above in the Akdzhar Formation, species appears - *Modiolus jeremejewi* Rom., *Cardita minutula* Rom., characteristic of the Danish and Zealandian stages. In places where the Akdzhar Formation is absent, the boundary passes at the base of the Bukhara Formation with *Lucina gravesi* Desh., *L. prevosti* Desh., *Corbula* (*Cuneocorbula*) *asiatica* Vial. of the Thanetian age. A foraminiferal complex with *Annectica paleocenica* Suleym., widespread in the Thanetian Stage, appears here.

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