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CALCAREOUS NANNOFOSSIL BIOSTRATIGRAPHY AND CORRELATION OF OLIGOCENE AND MIOCENE DEPOSITS OF GEORGIA

CONTENTS

Key words: Calcareous nannofossil, Biostratigraphy, Oligocene, Miocene, Georgia SSR.

ABSTRACT

The study of the calcareous nannofossils from the otherwise barren series of the Maikopian Clays allowed the recognition of Oligocene assemblages of the zones NP 21 - NP 25. In the Lower Miocene of Georgia, calcareous nannofossils are missing, while most of the Middle and Upper Miocene could be assigned to the standard NN zones. Thus the Oligocene and Miocene of Georgia could be correlated to the coeval layers of various regions of the Paratethys and the Tethys.

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RIASSUNTO

Lo studio dei nannofossili calcarei in serie delle Maikopian Clays, prive di altri organismi fossili, hanno consentito il riconoscimento di associazioni dell'Oligocene riferibili alle zone NP 21 - NP 25. Nel Miocene inferiore della Georgia i nannofossili calcarei sono assenti mentre il Miocene medio e superiore hanno potuto essere riferiti alle zone NN standard. In tal modo l'Oligocene ed il Miocene della Georgia hanno potuto essere correlati con livelli coevi di varie regioni della Tetide e della Paratetide.

INTRODUCTION

The marine Oligocene and Miocene deposits of Georgia which will be characterised below are restricted to the intermontane depression (Georgian Block) situated between the folded structures of the Great and Lesser Caucasus, being part of the Alpine folded belt. They are represented by some 2000m thick molassic sediments (Fig. 1).

The Miocene deposits are dated by macro- and microfauna which allowed the recognition of all the stages from the Aquitanian through the Meotian. Some problems of their biostratigraphy and their correlation to coeval deposits of remote regions are still under discussion. Our investigation of calcareous nannofossils has furnished important new results lately.

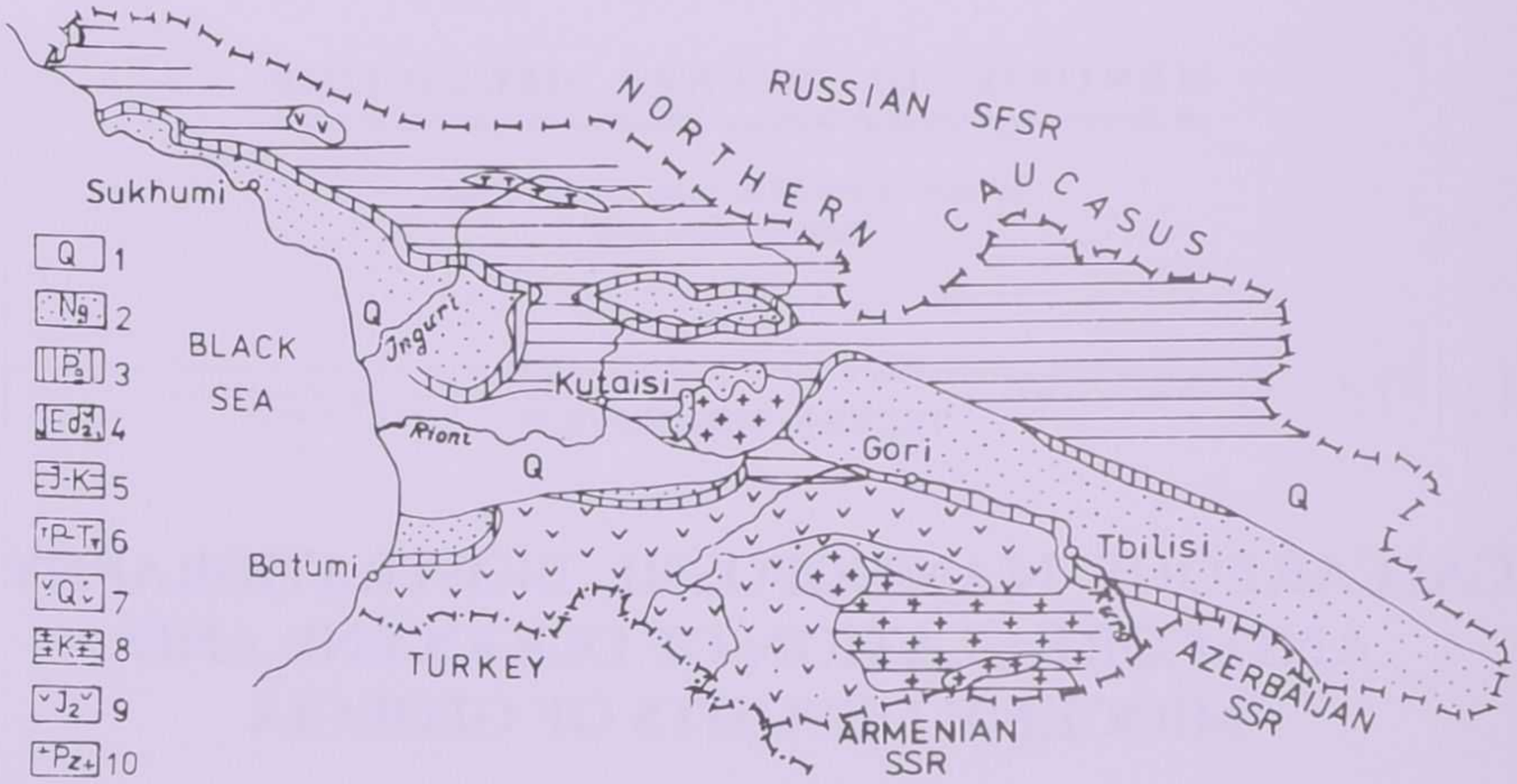

FIG. 1 - Schematic geological map of Georgia. 1: Quaternary alluvial deposits; 2: Neogene deposits; 3: Paleogene deposits; 4: Middle Eocene, volcanogenic series; 5: Undifferentiated Jurassic and Cretaceous; 6: Upper Paleozoic-Triassic; 7: Quaternary volcanics; 8: Cretaceous volcanogenic series; 9: Middle Jurassic granitoids; 10: Paleozoic granitoids.

VERTICAL DISTRIBUTION OF NANNOFOSSIL ASSEMBLAGES IN THE OLIGOCENE-MIOCENE

In the lower part of the Maikopian Clays the following nannofossil assemblage was found: *Reticulofenestra bisecta, R. dictyoda, R. callida, R. umbilicus, Isthmolithus recurvus, Zygrhablithus bijugatus, Coccolithus pelagicus, C. formosus, C. subdistichus, Discoaster distinctus, Rhabdoshaera tenuis, Chiasmolithus oamaruensis, Coronocyclus serratus, Transversopontis pulcher, Sphenolithus moriformis, Lanternithus minutus* and *Micula staurophora*, the latter reworked from the Upper Cretaceous. The absence of disc shaped discoasters and the presence of *C. formosus* and *C. subdistichus* assign this assemblage to the Lower Oligocene NP 21 of MARTINI (1971) or CP 16a of OKADA & BURKY (1980) and thus the Lattorfian (Fig. 2).

In the overlying layers (Figs. 2 and 3; Polbinian horizons, ostracoda layers) the following species were found: *C. pelagicus, C. eopelagicus, Cyclicargolithus floridanus, Pontosphaera multipora, Coronocyclus nitescens, Transversopontis obliquipons, T. zigzag, Reticulofenestra ornata, Zygodiscus vialovi, Sphenolithus sp.* The absence of *R. umilicus* (NP 22) and *Sphenolithus ciperoensis* (NP 24/25) and the presence of the local marker *Z. vialovi* ANDREEVA-GRIGOROVITCH 1981 assign the assemblage to the Middle Oligocene NP 23 or the Rupelian.

In continuous sections, the layers with *Z. vialovi* are conformably overlain by deposits of the same lithology, thus complicating the recognition of a boundary between the Middle and Upper Oligocene. In several sections, however, we found an assemblage differing from the underlying one: *C. pelagicus, C. eopelagicus, C. floridanus, P. multipora, Helicopontosphaera bramlettei, H. recta, Reticulofenestra sp., Z. bijugatus, Sphenolithus sp., S. moriformis, Discoaster adamanteus, Discoaster sp.*. This assemblage is tentatively assigned to the Upper Oligocene (Chattian) NP 24/25 on the basis of the presence of *H. bramlettei* and *H. recta* and despite the lack of the tropical marker *S. ciperoensis* or the temperate marker *Cyclicargolithus abisectus*.

The Oligocene/Miocene boundary is drawn above the beds including nannofossils of NP

EPOCHS	Subseries	Lithologie	B E D	Okada, Bukry (1980)	Zones	Subzones		Martini (1970)
MIOCENE	Lower	MAIKOPIAN CLAYS	Sakaraulian regio-stage with polyhaline Mediterranean molusc fauna					
			Uplistsichian(=Kaukasian) regio-stage; faunistically sterile Maikopian clays					
OLIGOCENE	Upper		Rukhian beds (complex with Helicopontosphaera bramlettei and H.recta)	CP19	Sphenolithus ciperoensis	CP 19b	Dictyococcites bisectus	NP 25
						CP 19a	Cyclicargolithus floridanus	NP 24
	Middle		Sachinoian beds (complex with Zygodiscus vialovi)	CP18	Sphenolithus distentus			NP 23
				CP17	Sphenolithus predistentus			
	Lower		Skurian beds (complex with Coccolithus subdistichus)	CP16	Helicosphaera reticulata	CP 16c	Reticulofenestra hillae	NP 22
						CP 16b	Coccolithus formosus	NP 21
						CP 16a	Coccolithus subdistichus	
EOCENE	Upper		Upperforaminiferal marls					

FIG. 2 - Division scheme of Maikopian clays of Georgia.

24/25. Above, in the Lower Miocene deposits of the regional stages Uplistsikhe (Aquitanian), Sakaraulian and Kotsakhurian, no calcareous nannofossils could be found, but occurrences of macro- and microfauna are used for their dating and correlation.

Calcareous nannofossils are again found in the overlying Tarkhanian regional stage, which was marked by the appearance also of a polyhaline macro- and microfauna: *C. pelagicus, C. floridanus, C. leptoporus, P. multipora, Discolithina latelliptica* BALDI-BEKE, *Helicopontosphaera kamptneri, Braarudosphaera bigelowii, Rhabdosphaera sicca, C. nitescens, Sphenolithus heteromorphus, S. moriformis, Lithostromation cf. L. perdurum, Discoaster variabilis*. This association from the Tarkhanian deposits with *S. heteromorphus* is typical for the lowermost part of NN 5 and correlates with the uppermost part of the Karpatian and the lowermost part of the Badenian regional stages or the top of the Burdigalian and the base of the Langhian.

Usually, the beds of the Tarkhanian are conformably overlain by Chokrakian deposits. Their nannoflora does not differ significantly from the underlying one, but *S. heteromorphus* has disappeared and *Perforocalcinella fusiformis* BONA has appeared. The occurrence of the latter is characteristic for the Chokrakian stage which, despite the lack of the marker species *S. heteromorphus*, is also assigned to NN 5. Towards the top of the Chokrakian stage, calcareous nannofossils become rare and are usually completely missing in the overlying Karaganian beds.

The Karaganian in Georgia is overlain conformably by the Konkian regional stage which is represented by diverse facies of coastal over transitional to abyssal character. The calcareous nannofossils in its lowermost part are either missing or represented by an impoverished assemblage of forms with a long stratigraphic range. In the upper part, richer assemblages are found: *C. pelagicus, C. miopelagicus, C. floridanus, C. leptoporus, Holodiscolithus macroporus, Reticulofenestra pseudoumbilicus, B. bigelowii, R. sicca, D. variabilis* and numerous *H. kamptneri*. The beds were thus called "beds with *H. kamptneri*". The absence of marker species makes a zonal assignment difficult, but the overlap of the ranges of *C. floridanus* and *R. pseudoumbilicus* above the last occurrence of *S. heteromorphus* allows a tentative assignment to NN 6/7. The boundary between

Epochs	Series	Biostratigraphy (Steininger, Rögl, Martini, 1976)			GEORGIA	
		Current European stages (Berggren, 1973)	Reg. stages of the C.Paratethys	N. zones (Martini, 1971)	Regional stages	Nanno-complex
MIOCENE	Upper	Messinian	Pontian		Meotian	
		Tortonian	? —— ?	(NN11)		Beds with C.macintyrei and Cat.cf.coalitus
				NN10		
			? —— ?			
	Middle	Serravallian	Sarmatian	(NN9)	Sarmatian	Beds with C.floridanus and R.pseudoumbilicus
				NN8		
			Badenian: Kosovian	NN7	Konkian	B. with H.kamptneri
			Badenian: Wielician	NN6		
		Langhian	Badenian: Moravian	NN5	Karaganian	
					Chokrakian	B. with P.fusiformis
					Tarkhanian	B. with S.heteromorph.
	Lower	Burdigalian	Karpatian		Uplistsikhe (Aquit.) Sakaraul, Kotsakhur	
			Ottnangian	(NN4)		
		Aquitanian	Eggenburgian	(NN3)		
				(NN2)		
				(NN1)		
OLIGOCENE	Upper	Chattian	Egerian	NP25 | NP24	Chattian	Complex with Helicopontosphaera bramlettei and H. recta
	Middle	Rupelian	Kiscelian	NP23	Polbinian horizon	Beds with Z. vialovi

FIG. 3 - Correlation of the Oligocene - Miocene deposits of Western Georgia with synchronous beds of other regions according calcareous nannofossils. ( ) Zones not represented.

the Konkian and Sarmatian stages in Georgia is then drawn above the beds with *H. kamptneri*.

The lower Sarmatian is characterised by the following nannofossil assemblage: *C. pelagicus, C. miopelagicus, C. leptoporus, R. sicca, Rhabdosphaera clavigera, B. bigelowii* and common *C. floridanus* and *R. pseudoumbilicus*. The temporal abundance of the two latter species led to the naming of a "bed with *C. floridanus* and *R. pseudoumbilicus*", which also shows an increase in *B. bigelowii*.

In the middle Sarmatian, the appearance of *Cyclococcolithus macintyrei* and *Catinaster cf. C. coalitus* suggests the presence of NN 8, the Middle Miocene *C. coalitus* Zone.

The upper Sarmatian is barren of calcareous nannofossils and thus NN 9 could not be recognised.

In the overlying Meotian, the following assemblage was discovered: *C. pelagicus, R. pseudoumbilicus, C. floridanus, C. leptoporus, B. bigelowii, S. moriformis, Helicosphaera sp., D. varia-*

bilis, D. neohamatus, Thoracosphaera sp. and, reworked from the Cretaceous, *Nannoconus sp.* The presence of *D. neohamatus* assigns the assemblage to the Upper Miocene, Tortonian NN 10.

The calcareous nannofossils assemblages of higher layers of the Meotian and of the Pontian are not diverse and include mainly long ranging species not allowing a zonal assignment: *R. pseudoumbilicus, B. bigelowii, C. pelagicus, S. moriformis, S. neoabies, Perforocalcinella fusiformis* and *C. floridanus.*

CORRELATION OF THE OLIGO-MIOCENE SEDIMENTS OF GEORGIA WITH THOSE OF THE PARATETHYS AND TETHYS

The correlation of the Maikopian Clays and the regional stages of Georgia and those of the Tethys and Paratethys is shown in Figures 2 and 3 based on the calcareous nannofossil zones recognised in this study. The deviations from the normal use of the standard calcareous nannofossils zones are summarised in the conclusions below. Note the absence of calcareous nannofossils in the Lower Miocene below NN 5, and in the Upper Miocene NN 9 and above NN 10, where correlations with the stages outside Georgia are based on general stratigraphic considerations.

CONCLUSIONS

The recognition of the Lower Oligocene NP 21 poses no problems, while the Middle Oligocene NP 23 is characterised by the presence of *Z. vialovi*, which can be traced throughout the Caucasus. Also NP 24/25 are not characterised by their usual markers but by the presence of. *H. recta* and *H. bramlettei* (Figs. 2 and 3).

The Miocene carries calcareous nannofossils from the Middle Miocene NN 5, where the marker species *S. heteromorphus* was found. NN 6/7 are not very well characterised other than by their position between well dated NN 5 and reasonably well developed NN 8 (*C. cf. C. coalitus*). While no assemblages of NN 9 were found, the presence of *D. neohamatus* without *D. hamatus* suggests NN 10 for the highest datable assemblages in the Tortonian (Fig. 3).

The occurrence of Oligocene and Miocene calcareous nannofossils allowing the use of slightly adapted standard zones calls for repeated open marine connections of the Georgian basin with the Central Paratethys, during which the migration of the above mentioned normal marine organisms could take place.

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