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• *Discussion*

Central Carpathian Paleogene and its constrains: replay to Gross & Filo' and Potfaj's comments

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The reviewed work Soták et al. (1996) is a part of selected publications originating as products of the project "Geodynamic model of the Western Carpathians". The publication represents the only work from the Paleogene sedimentary cycle in the West Carpathians resulting from this project. The paper sources from the themes solved on the mentioned project (not on the project Levoča Mts. - this project is identified by the authors of the review as their credit which is acceptable without doubts). The paper of Soták et al (1996) has been aimed at the search of ophiolite detritus sources in sedimentary formations of the Western Carpathians. The solution of this specific problematics in the eastern segment of the Central Carpathian Paleogene is introduced by a brief outline of lithofacial development and paleogeography of the Levoča Basin, which is analysed by detective approach by the authors of the comments (Gross & Filo and Potfaj 1998, last volume - l.v.). Unfortunatelly, as became a practise, the atitudes of the authors are not restricted for correct professional polemic but also for non-standard reactions. It is obvious that the shortened version of the paper Soták et al. (1996) does not give a room for a complete bibliography of the works dealing with Central Carpathian Paleogene, and it only selects works directly related to the topic of the study - e.g. to the petrofacial composition of flysch arenites and paleogeography of sources. Therefore it is not substantiated to consider selection and effectivity of references as an ignorance and violation of ethics (international periodics require it strictly). On the contrary the real information is often hidden and misrepresented by reference to the manifold (mainly own) group citations (see below). According to the authors who require to refer everything and about everything, hardly any paper would not violate the ethics. Even the omision of the nomenclature of lithostratigraphic units (Gross et al. 1984) is not possible to consider as non-ethical and it is not due to its complex rejection (they are well-founded in maps), but because they express a dominant lithology and not vertical and facial changes in deep-sea fan environments. Yet Zuberec Formation with megaturbidites near Dolný Kubín totally differs from Zuberec Formation in the development of thin to middle rhythmical turbidites (e.g. near Revištné, Oravice, Upper Torysa river in Levoča Mts., etc.) from the sedimentological point of view. Similarly Huty Formation characterized by a predominantly mudstone lithology includes of mudstone subflysch deposits but it also includes mudstone facies from various deep-sea fan zones (e.g. slope mudstone drapes, bypassing muds, interlobe levee deposits, basin-floor facies, etc.). On the contrary deposits of different lithology may occur in the same lithostratigraphic unit. For example, Biely Potok Formation prevailingly consists of conglomerates in the slope part of the deep-sea fan (Šariš Upland) while in the middle deep-sea fan zone it consists of massive sandstones of progradational lobe and suprafan sequences sometimes interfingered by levee mudstones (e.g. in profiles in the area of Upper Torysa river in Levoča Mts., in Orava region - Gross et al. 1993, p. 112). Therefore, it seems an actual need to redefine the formations of the Central Carpathian Paleogene (in the valid nomenclature of Gross et al. 1984) as depositionary systems of the deep-sea fans ("facies tracts" - cf. Mutti 1992). Then they will be fully acceptable not only from the viewpoint of descriptive lithology but also from the viewpoint of genetic classification.

By the description of sequences in the introductory part of the paper terms Tomášovce and Kežmarok Beds were mentioned as a potential lithostratigraphic members, which have been submitted for formal acceptance (by P. Gross and I. Filo). The mentioned terms were identified with marking of certain type sequences. The mention about them in the paper (only in explanatory brackets) should serve for elucidating described facies types from the viewpoint of their prepared nomenclature without any attemps which should evoke an impression of introduction of a new lithostratigraphic units. The reaction to this marginal remark is therefore inadequate and in the slightest it can not question the Gross and Filo's authorship of above mentioned lithostratigraphic units (the paper of Filo & Siráňová 1996, in which they codified Tomášovce Member, could not be referred because it has issued at the same time as the paper Soták et al. 1996). The term Kluknava Beds, was not taken only from Andrusov (1965, Kluknava "development", p. 246 – in Gross & Filo, l.v.) but also from Marschalko (1978, Kluknava Formation, p. 59), who´s proper description appears to be sufficient for lithostratigraphic acceptance (or for supplementary identification). Moreover, the name of Markušovce Beds proposed as a new lithostratigraphic unit by Filo et al. (1995), was identical to the unit defined in the Permian of the Northern Gemericum (Novotný & Mihál 1987). The purity of nomenclature, pressed by authors, is correct and they should try themselves to publish it as required the rules of stratigraphic nomenclature (the reference to manuscripts is not acceptable, e.g. Gross & Filo referred to 27 references and 14 of them are manuscripts). Only in this case they would be entitled to do such critique which otherwise only an evocation of feelings and useless search of conflicts there, where do not exist, It is particularly sorry, that Gross & Filo (l.v.) are representing their opinion as a state of collective opinion and institutional attitude. By this they for example suvereignily miss the problems around so called Šariš "Oligomiocene" and new results of stratigraphic and sedimentologic researches at Geological Survey of Slovak Republic (Janočko 1998, Janočko et al. 1998, etc,).

Much usefull are "matter-of-fact" comments (mainly in review of Potfaj), on which it is possible to response directly. Gross & Filo (l.v.) object against the Lower Oligocene age of transgression in the southern flank of the Levoča Basin, which is partly represented by Tomášovce Member. Their opinion is based on data of biostratigraphic research with numerous references to works on flora, macrofauna, microfauna and nanoplankton. The only data on macroflora from the eastern part of the Central Carpathian Paleogene basal formations originate from Hazslinsky (1852). They are from Radačov Sandstones

(Tomášovce Member sensu Filo & Siráňová 1996) and suggest Oligocene age. According to Němejc (1961) the macroflora from the surroundings of Radačov, but also from the other sites of the Central Carpathian Paleogene (Kluknava, Víťaz, Hrišovce, Smižany and others) contains of the Early Tertiary elements. He even does not exclude an Early Oligocene age. Macrofauna of the basal lithofacies deposits (Volfová 1962) consists of shells containing euryhaline species in the stratigraphic range Eocene - Oligocene, and that younger than in the assemblages of the Central Carpathian Paleogene of the Western Slovakia (p. 26). Similarly, the mollusc fauna of the Odorin limestones (planorbide gastropods) resembles the Lower Oligocene fauna of the Moutnice limestones of Ždánice Unit (Volfová 1963). The Upper Eocene age of transgression is according Gross & Filo (l.v.) also limited by the age of the Huty Formation overlying Tomášovce Member, which is mainly based on foraminifera data. Recently the foraminiferal fauna of Huty Formation has been studied by Samuel (1995) in the report resulting from the project Levoča Mts. at the Geological Survey of Slovak Republic. From the Huty Formation Samuel (l.c.) referred also foraminiferal species which appear from the base of the Oligocene (*Globigerina postcretacea*, *G. cf. tapuriensis* and *Turborotalia cf. densoconvexa*, p. 18); other Oligocene foraminifers, such as *Cibicides lopjanicus*, *Plectofrondicularia hauerina* and *Amphimorphina hauerina*, are common for example in Kiscelian Clays (p. 19). Further O. Samuel writes (p. 19): "Based on this reality we can state that the main part of the Huty Formation was deposited in the Lower Oligocene, while it is not possible to exclude that their lowermost part interfinger with the upper part of the Borové Formation" (e.g. Tomášovce Member). In order to support the Upper Eocene age of the Huty Formation Gross & Filo (l.v.) also introduce data on nanoplankton, mainly from the results of Raková and Korábová-Žecová. In the report of the second author (Žecová 1995, p. 1) it is stated that the analyzed assemblages of nanoplankton from the Huty and Zuberec Formations suggest Eocene up to Early Miocene age. At the same time the deposits of Huty Formation from the southern and northern part of the Levoča Mts. and Šariš Upland (localities Jablonov, Dačov, Šariš castle, Podolinec, Malý Šariš), which were analyzed by the author, yielded Lower to Middle Oligocene age. Results of Žecová (1995) are fully consistent with results of A. Nagymarosi, B. Hamršmíd and L. Švábenická, who studied nanoplankton of the Central Carpathian Paleogene of the Levoča Mts. (in report of Soták et al. 1996). The mentioned authors proved the Lower Oligocene age of the Huty Formation deposits also at localities Torysa, Jakubany, Rožkovany, Nižný Slavkov and others. The deposits of Huty Formation from Hornád Depression are mostly barren of nanoplankton (or they only contain stratigraphically unimportant forms), except the locality Dravce and Jablonov, where the Upper Oligocene age of deposits was proved (similarly as Žecová 1995). A similar consistency can be observed in results of Žecová (1995) and in the report of Soták et al. (1996) concerning determination of the Upper Oligocene formations and even in the registration of nanoplankton elements with affinity to the Early Miocene species (*Helicosphaera scissura*, *H. kamptneri*, *H. cf. carteri*, *H. cf. ampliaperta*, *Reticulofenestra cf. pseudoumbilicus*, *Triquetrorhabdulus cf. carinatus?* and others). It is mostly peculiar that the mentioned information on foraminifers and nanoplankton from the reports of Samuel (1995) and Žecová (1995) does not appear anywhere. On the contrary Gross & Filo (l.v.), who know best these reports, put forward their results as evidence for the Upper Eocene age of the Huty Formation. It is especially contradictory in the context of their suspicion concerning ignorance of results and misleading in rendered informations. To argue by reports of Samuel (1995) and Žecová (1995) in favor of the Upper Eocene age of the Huty Formation is possible only in conviction that these reports are restricted for internal use. But at the same time the authors point to the inaccessibility of reports of Soták et al. (1996), which are deposited in archives (Geofond - GS SR, Nafta Gbely, Nafta-východ Michalovce and GU SAV), where they are frequently look up for informations (e.g. Potfaj l.v.).

The most serious reluctance concerning the Upper Eocene transgression in Levoča Mts. stems from the fact of the absence of large foraminifers in deposits of basal formation (including Tomášovce Member). Gross & Filo (l.v.) offer an explanation that this is result of "decreasing salinity and muddy-rich nearshore water caused by rivers". The explanation is only hardly acceptable because the deposits of Tomášovce Member are not barren of fossils, on the contrary, they contain marine and relatively aboundant foraminiferal fauna but without nummulites. Foraminifera of Tomášovce Member mainly consist of representatives of *Rotallidae*, *Chiloguembelinidae*, and *Heterostegínidae?*. The marine origin of Tomášovce Member is also documented by abundance of crinoidal ossicles and more seldom fragments of coralline algae. Even the frequently referred fresh-watering of Odorín limestones is not substantiated because they even contains an admixture of foraminiferal plankton (neither the basal sediments of Paleogene nearby Veporic mainland, for example nummulite limestones in the Upper Hron area, are not fresh- and muddy-watered). The fresh-watering is not an explanation for the absence of nummulites in the Spiš segment of the Central Carpathian Paleogene because its southern margin is not a real coast line of the marine transgression, which undoubtelly extended more southerly. It is for example documented by findings of bathyal ichnofossils *Zoophycos* directly in the deposits of the basal lithofacies (locality Spišské Vlachy, Plička 1987) and also the development of the overlying deposits, which according to Marschalko (in Soták et al. 1996) shows immediately from the base a distal features (no marks of a river influx from the close mainland). Therefore it is necessary to accept, that the age of the basal deposits of the Levoča Basin in the Hornád Depression is younger as the range of the Eocene nummulites.

Gross & Filo (l.v.) also requires in the case of Kežmarok Beds an evidence of its Upper Oligocene age. Kežmarok Beds represent the uppermost part of the Zuberec Formation (Gross et al. 1996). Samuel (1995) refers foraminiferal assemblage of mostly Oligocene age from the Zuberec Formation and he states: "Because Kežmarok Beds form a sort of „transitional" strata between Zuberec and Biely Potok Formations we can consider their Oligocene age on the basis of superposition ..." (p. 22). Except of Poprad Depression the Kežmarok Beds are also developed as thick-rhythmical flysch deposits in the NE part of Levoča Mts. (e.g. in profile of Upper Torysa river area - Janočko et al. 1998), where their Upper Oligocene age is clearly documented by nanoplankton of zones NP 24 - 25 (Soták et al. 1996, Janočko et al. 1998). In context of stratigraphy of the Levoča Mts. it is possible to skip certain reminiscence. A success of the stratigraphic studies in the project of Levoča Mts. is essentially an agreement in opinion about younger age of formations in this part of the Central Carpathian Paleogene which has been achieved by independant approaches. It is only sorry that there is not a back reflection on periods of strict rejections of any ages younger than Lower Oligocene. So the denouement of these rejections is just here. At this time the new stratigraphic interpretation of the Central Carpathian Paleogene of the Podhale Basin has been published (Olszewska & Wieczorek 1998, Fig. 1). The results are fully in accordance with those obtained from the Levoča Basin (Soták et al. 1996, Soták in this volume),

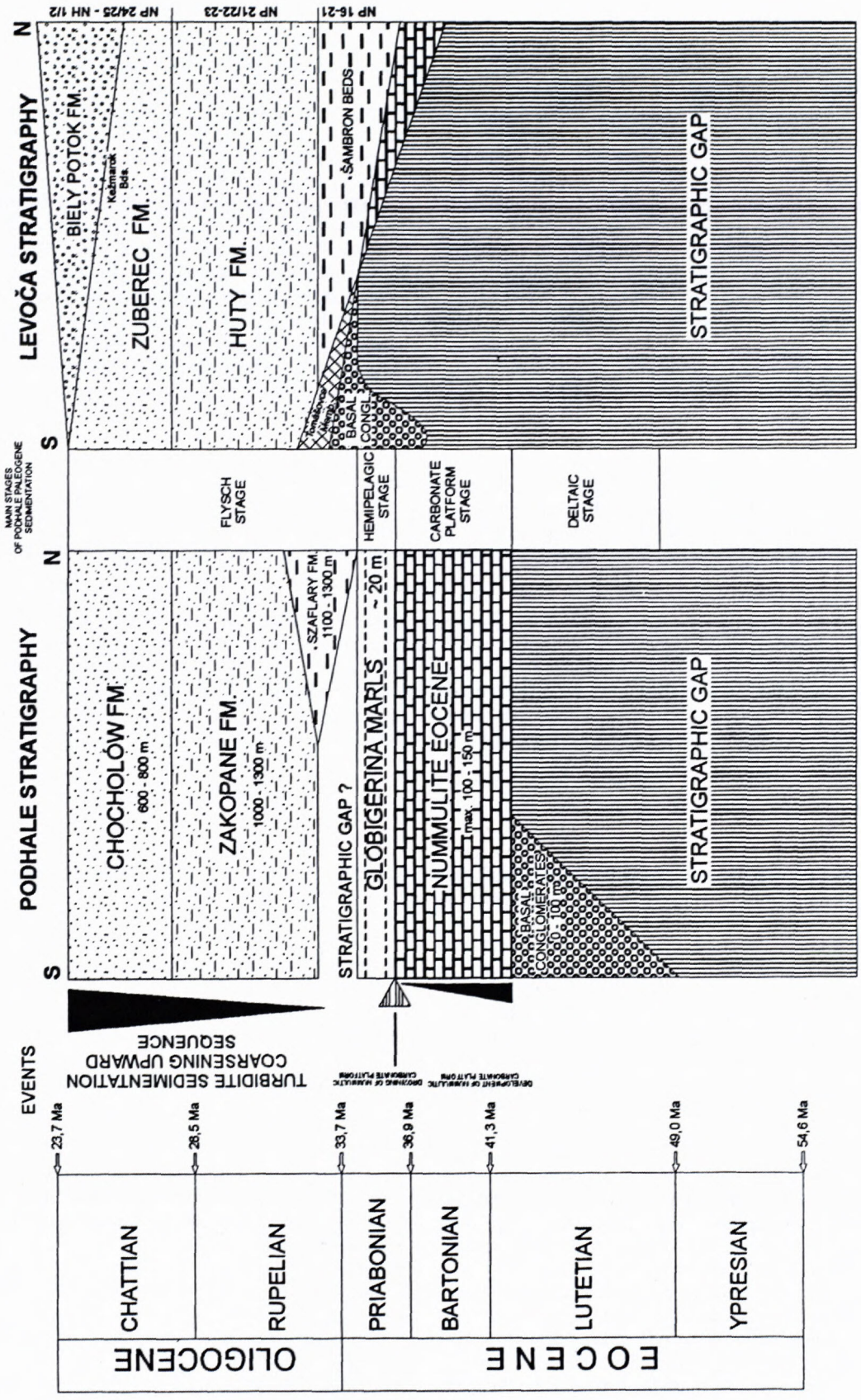

Fig. 1 Correspondence of Podhale stratigraphy and Levoča stratigraphy in new results of micropaleontological investigations. Podhale stratigraphy according to Olszewsk-a & Wieczorek (1998). Levoča stratigraphy as is interpreted in the works of Soták et al. 1996 a, b, Soták in this volume (Tomášovce Member sensu Filo & Siráňová 1996, Kežmarok Beds sensu Gross in press).

which have been refused and critized as unacceptable. Refusing these results, the Podhale stratigraphy becomes new and applicable for whole Central Carpathian Paleogene.

In the case of Kežmarok Beds Gross & Filo (l.v.) also question its distal development. But the reasons introduced by them (thick-rhythmical character, Ta stratification of sandstone beds) are not decisive from the viewpoint of distality or proximality. The Kežmarok Beds are developed in the fringe part of the depositional lobe area within the deep-sea fan system of the Šariš Upland and Levoča Mts., e.g. in the lower part of the middle fan. Its distality is already obvious from the paleocurrent orientation of this deep-sea cone, prograding in direction from SE to NW (Marschalko 1981). The thick-rhythmical character of the Kežmarok Beds does also not contradict it because fringe lobes gather clastics winnowed from the distributary channels of the middle fan. Therefore the Kežmarok Beds, representing deposits of concentrated suspensions, are developed in C facies types of Mutti (1979) as graded and massive sandstones, but with the less conspicuous development of progradational cycles (e.g. nearby Holumnica, Toporec and elsewere), rare appearance of channel erosion etc. The distality and deep water deposition of the Kežmarok Beds is at best documented by presence of ichnofossils *Taprhelminthopsis sp.* and *Fucoides graphicus* (directly at locality Kežmarok).

The main part of review of Gross & Filo (l.v.) and Potfaj (l.v.) is related to the problem of serpentinitic sandstones of the Šambron zone. Their findings are a success of the petrography of flysch arenites in the Western Carpathians, highly valued for example on international excursions. Already the primary information from the paper Soták & Bebej (1996) is interpreted erroneously. According to Potfaj (l.v.) the authors described "Šambron Beds with serpentinitic sandstones". This formulation does not occur anywhere in the mentioned paper because it is not precise. Soták & Bebej (1996) described serpentinitic sandstones from the Šambron zone from the Upper Oligocene formations younger than Šambron Beds. All following questions concerning origin of serpentinitic sandstones and modeled reconstruction of the Central Carpathian Paleogene fans stem from this misunderstanding. Thus, the authors of review lose this context and therefore the submitted reasoning seems dubious for them. Accordingly, the interpretation of suprafan seems to be dubious for Potfaj (l.v.). He writes that a suprafan is a morphological terms which can not be used for identification of development stage of deep-sea fan. The term suprafan does not defines only morphology (lobate-shaped bulge - Normark 1970), but also a depositional model for accumulation of sandy-rich fans. Because progradational types of fans are characterized by increasing rate of sandy deposition, their development commonly terminates in the sandstone accumulation of suprafan. Also according model of Mutti (1979) a suprafan progrades over deposits of basin plain, firstly by successions of sandstone lobes passing into non-channeled and later into channeled deposits and finally, into deposits comprising a sedimentary fill of the feeder channels. Such a model of suprafan is fully acceptable for reconstruction of deposition in deep-sea fans of the Central Carpathian Paleogene (similarly like Janočko et al. 1998). The sandy-rich formations of suprafan in the Central Carpathian Paleogene terminate a cycle of the deep-sea fan accumulation, but they probably not terminate the entire deposition (vitrinite reflectance data from the near-surface sediments of the Levoča Mts. respond for about 2 km thick of unknown overlying strata - Soták et al. in press).

Potfaj (l.v.) is also questioning a fact that the reviewed works do not deal with occurrence of conglomerate bodies in the Šambron Beds. In the work Soták et al. (1996), where Potfaj (l.v.) does not see any mention about conglomerates of Šambron Beds, it is devoted almost the whole page 346 to them (and to breccias). The absence of data on conglomerates in the work Soták & Bebej (1996) is logic because they do not occur in the described sequence of serpentinitic sandstones (only one layer of revorked autoclasts, Fig. 4) and their sequence is even not a part of the Šambron Beds. However, in the lithostratigraphic scheme of the Paleogene formations of the Šambron zone (Fig. 1) the Šambron Beds with intraformational conglomerates, are conspicuously marked. Further, Potfaj (l.v.) makes a query about the sense of commonly used term of Šambron zone (Šambron-Kamenica zone - Marschalko 1975 and elsewhere). By this meaning the author also determines position of conglomerates and suggest a possibility, that they does not have to be unconditionally a part of the Šambron Beds. At the same time the conglomerate bodies of the Šambron Beds are well exposed in the whole extent of the Šambron zone (from Šambron to Jakubovany or Pavlovce, respectively) and drilled by numerous boreholes (e.g. Šambron - 1, Plavnica - 1, Lipany - 2, 3, 6). Besides of the intraformational conglomerates of the Šambron Beds there are also different types conglomerate deposits which position is not so clear.

The term Šambron zone marks a belt of tectonically disturbed flysch sediments of the Central Carpathian Paleogene at its boundary with the Pieniny Klippen Belt. The Šambron zone is an antiform structure cored by the Eocene formations (Šambron Beds with intraformational conglomerate bodies, in boreholes Lipany - 6 as much as 4000 m), in its depressed parts the Lower Oligocene deposits of the northern mudstone lithofacies (Huty Formation) occur. In the slice belts of the Šambron zone also Upper Oligocene deposits occur occasionally, which exibit a thin-rhythmical character and have a specific detrital contents (serpentinitic sandstones, sandstones with tuffitic admixture). These formations do not have clear analogues in the Central Carpathian Paleogene (for example according to personal information of T. Ďurkovič they resemble Krosno Beds). The Upper Oligocene age of these deposits is erroneously related to Šambron Beds by Potfaj (l.v.) resulting in contradiction with their definition, correlation with Szaflar Beds and also with older data of biostratigraphical researches.

Potfaj (l.v.) also questions determination of the Upper Oligocene age of formation within the Šambron zone (erroneously understood as Šambron Beds) by nanoplankton. The Upper Oligocene age of these deposits was mainly proved by the occurrence of nanofossils *Cyclicargolithus abisectus*, which appear at the base of the biozone NP 24 (e.g. Krhovský & Djurasinovič 1992). However, Potfaj (l.v.) objects that this species also occurs in older sediments referring numerous supporting citations. Among first references it is a work of Dudziak (1993) here, who should describe an occurrence of *C. abisectus* from the Podhale Paleogene. But Potfaj (l.v.) missed a fact that the described species is not *C. abisectus* but *C. bisectus*. Similarly neither Oszypko (1996) refers species *C. abisectus* from the Upper Eocene and Lower Oligocene. The spesies, referred here, is marked by the author as *Cyclicargolithus aff. C. abisectus* and she writes „it has been described as transitional taxon between *Cyclicargolithes floridanus* and *Cyclicargolithes abisectus* occurred in NP 19-20 which is earlier than normal *C. abisectus* (p. 12). At the same time the author writes that „boundary between NP 23 and NP 24 is defined by first occurrence of *Cyclicargolithes abisectus* or *Helicosphaera recta* (p. 12). The following works referred by Potfaj (l.v.) in order to support the earlier apearance of the species *C. abisectus* are already studies from the Middle/Late Oligocene deposits of the zone NP 24 (for example from Štibořice Member - Bubík 1996, from the deposits of the Banská Bystrica Depression - Bystrická 1979). Neither the following data of Potfaj (l.v.) about syn-

onymity of the species *Cribrocentrum reticulatum* is not correct, because its synonym is not the species *Reticulofenestra lockeri* but the Eocene species *Reticulofenestra reticulata*. Therefore the objections against the Upper Oligocene age of the deposits containing *Cyclicargolithus abisectus* does not correspod to the real knowledge from the biostratigraphy of nanoplankton. At the same time their age determination is not based only on three species from the locality of serpentinitic sandstones, but on the knowledge about distribution of nanofossils in the Central Carpathian Paleogene of the Levoča Mts. (Nagymarosi, Hamršmíd & Švábenická in Soták et al. 1996), where the species *Cyclicargolithus abisectus* is absent in the Šambron Beds (zones NP 16 to NP 21) and also in the deposits of the mudstone subflysch (Huty Formation, NP 21/22 - NP 23). It appears as soon as in the deposits of the Upper Oligocene age (zone NP 24 and NP 25).

Potfaj (l.v.) and Gross & Filo (l.v.) widely comment a figure from the work of Soták et al. 1996 (Fig. 2) reproaching its basic shortage. The figure is a modeling construction of the eastern branch of the Central Carpathian Paleogene and it should illustrate a longitudinal orientation of a deep-sea fan (according to Shanmugan & Moiola 1988 typical for active-margin fans), its marginality to eastern sources, perisuture position of the northern margin of the Central Carpathian Paleogene etc. Thus, it is very complicated reconstruction of the collisional orogen system depicting the subduction of complexes beneath the orogen (underplating), collapse of the plate margin in the zone of synconvergent extension, oblique plate convergence on collisional boundary, buoyancy of the subducted complexes in the strike-parallel wrench zone, accretion in the trench zone etc. It is natural that there is no model reconstruction without errors, the reconstruction can only be more or less successful. The model is actually a proposal of some solutions which may or may be not accepted. In this way it by rule installs more questions as it solves itself. But the authors of these reviews require definite solutions without making more clear all interdependences.

The most conspicuous feature of the critized model is reconstruction of the deep-sea fan consistently with paleocurrent directions proved by Marschalko (1966, 1981) and confirmed by a new paleocurrent research of Soták et al. (1996). The researches from Podhale (Radomski 1958, 1959, Krysiak 1976 and others) does not solve a presented model, because they document opposite paleocurrent systems. Inspite of a clear depicted SE - NW longitudinal system of fans in the scheme, Potfaj (l.v.) criticizes its absence. The further reasoning of Potfaj (l.v.) is erroneous because he changes suggested alternatives for the detrital origin of the Šambron Beds ("from slopes of the active Central Carpathian plate or from its northern collisional edge") with the longitudinal system of the Upper Oligocene deep-sea fans. The works from the Polish Podhale (Mastella 1975, Mastella et al. 1977, 1978) referred by Potfaj (l.v.) do not clearly prove the presence of the klippen material in Szaflar Beds. Mastella et al. (1977) only writes about transport directions with orientation 70 - 80^{O}, mostly from the west (p. 495).

In both comments the problems connected with the position of the Klippen belt are shown. Its position within the collisional system is a puzzle always suggesting a lot questions, which can be as follows: Is a material contrast of the Šambron zone and Klippen belt conglomerates an evidence for juxtaposition of originally very distant units? Were they bringing together due to ocean reduction south of the Klippen belt (an alternative of Iňačovce-Krichevo subduction and perisutural position of the Central Carpathian Paleogene Basin is well illustrated by Kováč et al. 1994)? Is it possible that the Klippen belt with some affinities to the North-European platform (e.g. Klippen belt fauna of *Cardioceratidae* in the more southern units not known - Kutek & Wierzbowski 1986, heavy mineral associations with pyrope-type garnets which are similar to those in eclogites of the Bohemian Massif and not in the Central Carpathian units - Aubrecht et al. 1997, termination or shallowing of the Czorsztyn succession during the regional regression on the platform etc.) would comprise a collisional margin of the Central Carpathian plate? Is the Klippen belt a remnant of a narrow and 800 km long continental ribbon like as "seamounts" or it is an annected part of the North European platform formed as soon as in onset of the continental collision and strong transpression on the plate boundary? Is it possible that Magura Unit as a largest trench-type unit of the Western Carpathians would be accreted from the platform? One of the possible solution of these questions is also integration of the Oligocene basins of the central and external Carpathians without more conspicuous morphostructural expression of the Klippen belt, which is illustrated by criticized scheme. Gross & Filo (l.v.) object against the neighbouring of two sea basins not separated by mainland because Central Carpathian and Magura realm represent according them two marine provinces with the entirely different formations and with different depositional regime. During the Oligocene the Magura basin and Klippen belt occurred in the depositional area of the Malcov-Menilite serie. The facial development of the Malcov Beds in the depressed parts of the Klippen belt (e.g. in Ujak-Plaveč area) is already very similar to the Central Carpathian Paleogene formations (Uhlig 1890, Nemčok et al. 1990, p.63). It conspicuously resembles for example the Lower Oligocene sediments of the mudstone lithofacies in the Šambron zone (Huty Formation). In the area of Nowy Targ in Poland the Malcov Beds were even originally mapped as Zakopane Beds of Podhale Paleogene and they also exhibit the same paleotransport patterns (M. Cieszkowski pers. communication). On the other hand the influence of the Malcov - Menilite type deposition of the Outer Carpathians is also manifested in the Central Carpathian Paleogene (Soták this volume) whether they are Menilite Beds (Leško 1960 a), *Globigerina* Marls or Šariš Beds strikingly resembling lithofacies of Krosno Beds (Leško 1960 b). It is also remarkable that the paleocurrent system of the Central Carpathian Paleogene is not reoriented even in the close proximity of the Klippen belt, it tends obliquely to it with orientation to NNW (for example between Sabinov and Ratvaj). Therefore an idea of an undissected basin covering the margins of the Central Carpathian plate, trench zone and areas of Krosno-Menilite sedimentation is acceptable for the Oligocene paleogeography, which is shown on the criticized scheme. The interpretation of the Central Carpathian Paleogene comes out from the same idea in the work of Nemčok et al. (1996). He sees in it a "proximal facies of the West Carpathian Flysch Belt" (p. 321).

In the discussed model also an existence of the oceanic crust in the subducted substrates of the flysch units is questioned by Gross & Filo (l.v.). But based on the today's ideas it is clear that without oceanic crust the space shortening, which is enormous in the Western Carpathians, is not possible, and just on the detriment of the northern flych units. On this basis not only individual approaches but also research teams of international projects work (e.g. PANCARDI). Just findings of serpentinitic sandstones in proximity of the main suture related to the boundary of the Central and Outer Carpathian units (Soták & Bebej 1996) support an existence of oceanic crust. Their importance can not be lowered by their alleged sporadic occurrence (Gross & Filo l.v.) because ophiolite traces are also on big suture zones mainly preserved in form of residual detritus (for example Cr-spinels) and a rare occurrence of serpentinitic sandstones already directly indicates a proximity of serpentinite belts (see Arai & Okada 1991, Okada 1964, Dickinson 1982, Zimmerle

1968, Critelli 1991, 1993, Wagreich 1993 and elsewhere). Moreover, the occurrences of serpentinitic detritus in the Šambron zone by far are not already sporadic. Besides own localities of serpentinitic sandstones nearby Kamenica (Lipany creek, Slané Mláky, Putnov creek), numerous clasts of serpentinites were recorded nearby Šambron (borehole PU-1), Lipany (borehole Li - 6), Hanigovce and Pavlovce. Even more conspicuously the concentration of ultrabasic source detritus in Šambron zone is indicated by heavy minerals consisting of high amount or often even monoassociations of Cr- spinels (Soták et al. 1996). Similarly the Šambron zone is manifested by regional results of heavy mineral concentrate analysis (Križáni 1985) as a conspicuous Cr-spinel anomaly extended as far as Spišská Magura. The distribution of the detritus is not restricted to the Central Carpathian Paleogene as referred by Potfaj (l.c.). The detritus of ultrabasic sources is also recorded in Malcov Beds by Cr-spinels in sandstones (e.g. locality Ľubotín - 16%, Soták et al. 1996) or in heavy mineral concentrates from Malcov-Richvaldy belt (Križáni 1985).

In context of ultrabasic detrital sources Gross & Filo (l.v.) pose a question whether it should be ..."an emerged mainland (trench) in area of Upper Oligocene Klippen belt". The formulation of the mentioned question is contraversial because a source does not to be a mainland and a mainland is not a trech. Soták et al. (1996) assumes a location of ultrabasic sources in front of the collisional margin of the Central Carpathian plate but not as an emerged mainland identical with the Klippen Belt. According to Gross & Filo (l.v.) is not clearly indicate the active plate margin on the figure, which in the illustrated model of synconvergent extension is outlined by marginal blocks tilted toward trench side (the plate margin and trench are also marked by names here). Potfaj (l.v.) is also critical from the viewpoint of mechanisms by which ophiolite detritus might be brought into sedimentary basin. He gives arguments that oceanic crust can not be exposed to subaerial sources (in his case always cordilleras - Potfaj 1997) and he writes "what a morphological and structural body would this source to be: - an intraoceanic peri-subductional cordillera? - such a form is not known to the actual geology, and is hardly interpretable". The expressions of Potfaj (l.v.) are surprising because an existence of forearc serpentinite seamounts forming 10 - 20 km wide and as much as 1 000 m high elevations consisting of ultramafic and mafic rocks (Charvet & Ogawa 1994) is known just from the geology of modern plate boundaries. Such seamounts are interpreted as either serpentinite diapires (Hussong & Freyer 1985) or serpentinite domes (Lagabrielle et al. 1992). The orientation of Potfaj to cordillera-type sources is one-tracked and it was not considered in serpentinitic sandstone sources described in works of Soták & Bebej (1996) and Soták et al. (1996). The topography of plate boundaries is yet even without cordilleras sufficiently contrast to derive subducting oceanic crust, whether by off-scraping, obduction, buoyancy and diapir penetration into sutures etc. Such sources for example might be elevated accretionary wedges giving material of the subducted plate to trench and forearc basin sides (cf. Cloos 1982). Similarly the serpentinitic sandstones of the Šambron zone were interpreted as distal to trench turbidites derived from oceanic crust slices imbricated on plate boundary.

The indications made by Gross & Filo (l.v.), concerning the general knowledge about the decreasing carbonate detritus toward the higher formations of the Central Carpathian Paleogene and increasing amount of siliciclastics are not enough factual. They need to be supported by a detail, in the case of the work of Soták et al. (1996) petrofacial reseach. Generally known facts have then not occur as valid by rule in detail (e.g. evidence of an amount of volcanoclastic detritus in the sandstones of the Biely Potok Formation or evidence of serpentinitic detritus in the youngest formations of the Šambron zone etc.).

In the conclusion of both reviews it is preffered a search of ultrabasic detrital sources of the Šambron zone in the Gemericum. According to Gross & Filo (l.v.) such an approach provides simplier solution and it is consistent with the SE - NW orientation of paleotransport (Marschalko 1978). However, the submitted simple solutions become more complicated by the existence of large displacements on transform faults, block rotations, amputation of sources from marginal facies, younger processes of subduction followed by upwelling and unroofing of underplated crustal segments etc. Gross & Filo (l.v.) argue by presence of serpentinites in clasts of Paleogene conglomerates from the surroundings of Margecany (Šalát 1954) and in the body nearby Sedlice. On the contrary Potfaj (l.v.) excludes the Sedlice body and he does not specify more closely the southern sources. The conglomerates located nearby Margecany probably represent continental deposits (they are red coloured - Šalát 1954, p. 208) deposited from alluvial aprons and local sources (Marschalko 1965, 1970). The clasts composed of Gemeric ultrabasic rocks occur in conglomerates nearby Margecany as well as Kluknava and Markušovce, however, they are metamorphic rocks with Cr-magnetite or Cr-spinels of brown colour. They entirely differ from the red, higher aluminous Cr-spinels of the Šambron zone. The conglomerates of the pre-transgressive formations were accumulated in valley-like depressions filled from SW to NE (Marschalko 1970) it means in the opposite direction than the deep-sea fan orientation of the Central Carpathian Paleogene which distal facies are significantly enriched in serpentinitic detritus. The clasts of ultrabasic rocks does not occur in slope conglomerates of the deep-sea fans in the eastern part of the Šariš Upland. Neither the main volume of deep-sea fan accumulation in the Levoča Mts. consisting of siliciclastic deposits with dominance of garnet-turmaline association in heavy minerals does not contain it (in contrast to Cr-spinel association of the northern zone, Soták et al. 1996).

To solve the provenance of the serpentinitic detritus of the Šambron zone from the Gemeric sources is also problematic from the viewpoint of distance. The findings of serpentinitic sandstones in the Šambron zone are far off about 50 km from these occurrences in Gemericum. In the work Soták & Bebej (1996) a local origin of the ultrabasic detritus of the Šambron zone has been emphasized regarding to the fragility of serpentinitic clasts which would be not preserved in such concentrations during the long-distant transport in the high dispersive pressure flows. The occurrence of Cr-spinels in the Spišská Magura Mts. (Križáni 1985) as well as its easternward tracing up to the Transcarpathian Ukraine (Kruglov 1974) is at all not possible to solve from the position of Gemeric sources. For example, the body of ultrabasic rocks nearby Sedlice, mentioned in the reviews, is not even in its closest surroundings accompanied by the occurrence of serpentinitic sandstones (only scarce spinel grains were recorded here), ultrabasic rocks are even absent in the material of conglomerates in which the body is placed. On the contrary conglomerates cropping out in the close surroundings of the Sedlice body consist of such pebbly material which by no way can be derived from either the Gemericum or Mesozoic series of the Čierna hora Mts. (e.g. Urgonian limestones with *Orbitolina*, Lower Cretaceous shallow-water carbonates of the Brekov Limestone type, Majolika type of *Calpionella* limestones and so on, containing a small amount of Triassic dolomites and limestones, everything lacks of metamorphic recrystalization typical for the Mesozoic rocks of the Hrabkov serie). Also from this reason the position of the Sedlice body is uncertain and it is possible to consider it as a

more important source of Paleogene clastic deposits. As already was pointed out before (Hovorka et al. 1985) the Sedlice body is an exotic peridote klippe occurred within the Central Carpathian Paleogene, which is entirelly different of ultrabasic rocks of Gemericum (minimal degree of serpentinization, different structural character, presence of ophicalcite breccias etc.). It means that even the Sedlice body does not need to be derived from Gemericum. On the contrary they may be an ultrabasic rocks similar to those indicated by a conspicuous magnetic anomaly in the easternmost part of the Šariš Upland (Bzenov anomaly - Gnojek 1987) and to rocks penetrated by a drilling in a shallow depth nearby Prešov (borehole V-1, Slávik 1974). The detritus of ultrabasic rocks, essentially accumulated in Merník conglomerates, probably originated from similar bodies (Soták et al. 1990). Such ultrabasic bodies could be exposed in the Iňačovce-Krichevo Unit in the final phase of their exhumation (Early Miocene).

The attitudes of authors to the Iňačovce-Krichevo Unit lack clarification of problems. It is partly given by a real degree of knowledge on this unit where so far gap exists mainly in the matter of timing of the Iňačovce-Krichevo subduction, tectonic burial, metamorphism, exhumation and uroofing. However, the basic facts are known and in the main features depicted in the model reconstruction of Soták et al. (1996). Iňačovce-Krichevo Unit was formed within the subducting substrates of extratatric domain as a unit with oceanic-type crust and Jurassic-Cretaceous and Paleogene formations of shally-turbiditic lithology. During the subduction the complexes of the Iňačovce-Krichevo Unit were deeply buried and undergone metamorphism in temperature around 350 - 400^{O} C (chloritoid shists) and in intermediate greenshist/blueshist pressure conditions (magnesioriebeckite + actinolite + epidode). The youngest metasedimentary formations of the Iňačovce-Krichevo Unit involved in subduction, are of Eocene age. Their incorporation into subduction-accretionary complex documents neoalpine age of the final phases of Iňačovce-Krichevo metamorphism. The uplift of subducted complexes was being realized in the Late Oligocene and reached a depth of zircon FT blocking temperature (ca 220^{O}C) around of 20 Ma (Dunkl in Soták et al. 1997). It means that yet in the Early Miocene the Iňačovce-Krichevo Unit occurred in the depth of some 5 - 7 km underneath complexes of tectonic hangingwall. The final phase of core complex exhumation of the Iňačovce-Krichevo Unit and its displacement to the East Slovakian Basin floor was probably controlled by the Middle Miocene back-arc extension realized through detachement faulting and unroofing. This conception of the Iňačovce-Krichevo Unit development has surely its weak points and unsolved questions but not in such a way as stated Gross & Filo (l.v.) and Potfaj (l.v.).

Gross & Filo (l.v.) and Potfaj (l.v.) are wrong in the basic idea concerning the position of the Iňačovce - Krichevo Unit during the Upper Eocene and Oligocene arguing why its exposed substrates should be not a source of flysch clastics of the Central Carpathian Paleogene. Yet in the work of Soták et al. (1996) and elsewhere (Soták et al. 1993, 1994, 1995, 1996b, 1997) it is emphasized exactly the reverse side view consisting of a deep burial of the Iňačovce-Krichevo Unit in subduction zone evidenced by metamorphose of the Eocene formations (Potfaj l.v. is reasoning very consistently with this idea and it is not clear what is the problem). Therefore the material of the Central Carpathian Paleogene sediments is not derived from the Iňačovce-Krichevo Unit but from its hangingwall substrates probably consisting of Central Carpathian units. The force of these sources resulted probably from exhumation activity of the Iňačovce-Krichevo Unit in a mid-crustal depth during the Late Oligocene. The occurrence of rocks resembling rocks of the Iňačovce-Krichevo Unit in the conglomerates of the Šambron Beds was mentioned in the work of Soták et al. (1996) not in connection with its exhumation (exposing of substrates) but with its subduction (underthrusting of substrates). The occurrence of these type rocks in the Šambron Beds is a reality which can not be disparge by their ubiquitous occurrence (as far as Horná Nitra region - Gross & Filo l.v.). The rocks are specific types of green, dark and cream-brown phyllites, calcphyllites and light-coloured marbles (not gneisses, amphibolites, quartzites as referred Gross & Filo l.v.) which affinity to rocks of Iňačovce-Krichevo Unit is for example manifested by scaly fabrics, small-scale folding, crenulation by cleavage systems, entirely recrystalized primary structures (e.g. on the contrary to the Veporic Mesozoic rocks of Hrabkov Serie) and petrographic composition. A possible explanation of the occurrence of these rocks in the Šambron Beds (perisutural zone) is their retrieval from the subduction scar driven by buoyancy flow similarly like glaucophanites or eclogites appear in blocks of sedimentary melanges.

Gross & Filo (l.v.) question the significance of the Iňačovce-Krichevo Unit from the position of "complete hiding" and only recovering in sporadic boreholes. The approach presented does not appreciate data from the deep structure research. The interpretation of the surface geology without these data is not possible. Yet it is sufficiently known the complexes of the Iňačovce-Krichevo Unit were recovered by a series of 24 deep boreholes in the following sites: Iňačovce-3 (1334 m), Iňačovce-2 (30 m), Iňačovce-1 (10 m) Zbudza-1 (974 m), Lesné-1 (965 m), Lesné-2 (538 m), Bunkovce-1 (862 m), Michalovce-1 (360 m), Vysoká-1 (100 m), Pavlovce-1 (500 m), Senné-1 (103 m), Senné-2 (608 m), Senné-8 (291 m), Blatná Polianka-1 (302 m), Blatná Polianka-2 (80 m), Blatná Polianka-3 (90 m), Hrušov-1 (155 m), Rakovec-3 (202 m), Trhovište-26 (117 m), Pozdišovce-1 (281 m), Rebrín-1 (106 m), Lekárovce-1 (458 m), Pinkovce-1 (100 m), Pinkovce-2 (3 m). This unit with the entire depth of the recovered profiles about 9 km is one of the best investigated pre-Neogene units on our territory. Only thank of this such peculiar phenomenon as metamorphism of Eocene formations, Penninic-like lithologies, occurrence of ultrabasic bodies even in overthrusted position on the Eocene metasediments (underplate duplexes), subduction-accretionary style of deformation, Early Miocene FT dating of zircons, occurrences of ultramylonites on exhumation detachements etc. (Soták et al. 1993 - 1997) could be identified here. Assignement of these facts into position of unproved facts and wishes (Gross & Filo l.v.) is not substantiated. They can be seen in this position only in the distorted interpretations like that presented in reviews (see above).

The comments to the work Soták et al. (1996) dealing with the petrofacial composition of flysch arenites forced response to questions, which were open prematurely and uselessly in confrontational way (more works are just in press or under preparation). The problems of the Central Carpathian Paleogene gained on dynamics. However, this requires a patient evaluation of new facts and new solution approaches. At the same time the contradictions in the problems of the Central Carpathian Paleogene are from far not so dramatic as they are rasantly formulated by authors (Gross & Filo l.v.). There are mainly some different opinions but from a great part also misunderstandings, which are normally resolved by clarification and not contradiction. The results presented by works of Soták et al. (1996), Soták & Bebej (1996) and others are not commited to be the only one and the most correct, many of them are formulated as preliminary or alternative solutions which may be later supplemented or changed. But they stem out from real facts and arguments and in absolutely responsive and correct approach. It is

only sorry that the authors of reviews are not more open for accepting results from other research activities in the Central Carpathian Paleogene, which they could by their rich experience to inspire and not a priory reject.

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