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The contributions of D.P. Naidin to the study of the Cretaceous system

by Jake M. HANCOCK

Abstract

Dmitri Pavlovich NAIDIN has advanced our knowledge of the Upper Cretaceous in his studies of belemnites, biostratigraphy, palaeogeography, the K/T boundary, geochemistry and isotope studies. For the world at large his most important contribution has been his leadership in Russia which he has used to build and maintain geological contacts between the eastern and western political blocks.

Key-words: K/T boundary, belemnites, stratigraphy, palaeogeography, palaeotemperatures, eustasy, international relations.

Résumé

Dmitri Pavlovich NAIDIN a fait progresser notre connaissance du Crétacé supérieur par ses études concernant les bélemnites, la biostratigraphie, la paléogéographie, la limite K/T, la géochimie et les isotopes. A l'échelle mondiale, sa contribution la plus importante fut son leadership en Russie qu'il a mis à profit pour maintenir des contacts géologiques entre les groupes politiques de l'est et de l'ouest.

Mots-clefs: transition K/T, bélemnites, stratigraphie, paléogéographie, paléotemperatures, eustatisme, relations internationales.

Резюме

Работы Дмитрия Павловича Найдина в таких областях как белемниты, биостратиграфия, палеогеография, граница К/Т, геохимия и изотопы, способствовали усовершенствованию наших знаний о Верхнем мелe. В Росиии, Дмитрий Павлович использовал свое широкое влияние в целях поддержания сотрудничества политических групп Запада и Востока в области геологии, что, несомненно, является его главным вкладом на мировом уровне.

Ключевые слова: граница К/Т, белемниты, стратиграфия, палеогеография, палеотемпературы, глобальный уровень моря.

Cretaceous sediments are spread over enormous areas of the Russian Federation and neighbouring countries (see fig. 4 in NAIDIN *et al.*, 1986). It is hardly surprising that a number of Russian geologists have been famous for their studies of Cretaceous rocks; Archangelsky and Bushinsky come immediately to mind. In the second half of the 20th century the most widely known name in the western countries has been Dmitri Naidin because of the exceptionally broad range of his publications which impinge on palaeontology, biostratigraphy, regional geology, sea-level changes and isotope geochemistry.

Background and early days

Dmitri NAIDIN was born on 28 January 1919 at Kremenchug on the Dnieper in the Ukraine, some 250 km south-east of Kiev. His father was a respected expert on fertilisers who worked at an agricultural institute in Kiev. In addition to the usual elementary education in the USSR, the young Dmitri was given private lessons in German, regarded in eastern Europe as the cultural language of science.

When Dmitri was about 12 his family moved to Moscow where his father became a senior research scientist at the All Soviet Institute of Fertilisers, Agricultural Techniques and Chemistry. Dmitri finished at secondary school in 1937 and started as a student in the Geology faculty at the Institute of Geological Prospecting in Moscow (MGRI), graduating in 1941 as an engineering geologist, specialising in geological mapping and prospecting. For a few months he worked in the Geological Survey of the Tadzhik Soviet Republic, a mountainous region to the east of Samarkand.

On 22 June 1941 Germany invaded the USSR. In March 1942 Dmitri was conscripted into the army. Until 1943 he trained at the Voronesh Military School of communications, graduating as a junior officer. He served as the commanding officer of communication sections of anti-aircraft units until being demobilised in February 1946 with the rank of ''starshiy leitenant'' (Senior Lieutenant).

Geological career in outline

With the end of the Great Patriotic War, Naidin became head of the Lvov section of the Carpathian expedition in

1946, under the direction of Professor A.A. Bogdanov. From 1949 to 1951 he was assistant to Bogdanov at MGRI (Moscow Geological Prospecting Institute). During this time he obtained his Ph.D. on ''Upper Cretaceous deposits of the SW part of the Russian Platform''.

When Bogdanov moved from MGRI to MGU (Moscow State University, also known as the Lomonosov University) in 1951, Naidin moved with him as his assistant. In 1952 Naidin published his first major paper on belemnite taxonomy and stratigraphy (see below). He became a ''docent'' (lecturer) at the university in 1953. He was awarded a higher doctorate in 1965, and in 1966 became a Professor at MGU where he was employed for the remainder of his career and continues to play an active role in research.

In addition to many prestigious posts in Russia, e.g. editor and member of Council of the Moscow Society of Naturalists (MOIP) which awarded him their principal prize in 1973, Naidin has been a major participant in the International Geological Correlation Programme, and from 1975-1984 was the only Voting Member from the USSR on the International Subcommission of Cretaceous Stratigraphy. These international appointments have been important vehicles for Naidin's contacts with geologists outside the USSR.

Belemnite research

Naidin's early work was on belemnites and their stratigraphy. In his 1952 monograph he attempted a comprehensive survey of all the Upper Cretaceous belemnites of the western Ukraine, and their inter-relations, largely based on the succession in the Opolie area of the Dnestr valley, north-north-west of Ivano-Frankovsk (= Stanislav). More extensive studies of the taxonomy were published 12 years later (NAIDIN, 1964a, b; 1965). *Belemnitella* and *Belemnella* were covered rather briefly at this time, and fuller accounts were given in his 1969 book and in the Atlas of the Upper Cretaceous fauna of the Donetz Basin (NAIDIN, 1974), particularly near Voroshilovgrad (= Lugansk) in the eastern Ukraine. There were also important taxonomic corrections in NAIDIN (1975).

Amongst this taxonomic work he proposed a new classification of the belemnitellids that lack a true alveolus, whose relationships had never properly been considered before. He established two new subgenera of *Actinocamax: A. (Praeactinocamax)* and *A. (Paractinocamax);* a new genus, *Belemnellocamax;* and a new subgenus of *Gonioteuthis, G. (Goniocamax).*

The studies were extended southwards to the Crimea and eastwards to the Caspian syneclise (= shallow basin) around the northern part of the Caspian Sea (summaries in NAIDIN, 1969, 1979, 1981).

As a result of this broader area of study (from western Ukraine to the Mangyshlak Hills on the north-east side of the Caspian is approximately 2,200 km, about the same distance as from the Gulf of Mexico to the Canadian border), Naidin realised that the use of belemnites for stratigraphy was much more complicated than previously realised. Not only were many regional belemnite appearances the result of immigrations rather than evolution in place - this had been realised for many years by anyone who cared to think about the sudden appearance of new taxa without evolutionary predecessors. Nor, that one genus or species might be ecologically excluded by another (NAIDIN, 1959). Far more serious was the discovery that zonal boundaries could be diachronous over a few hundred km. For example, in the Crimea one could recognise two zones in the Upper Maastrichtian: *Belemnella kazimiroviensis* above and *Belemnitella junior* below. As one goes eastwards from Crimea to the Volga Basin, the *B. junior* Zone thins and disappears and that of *B. kazimiroviensis* thickens (Fig. 1). This is not a matter of sedimentation (although there are sedimentary complications as well): other indicators for the boundary between lower and upper Upper Maastrichtian show that both subdivisions of the Upper Maastrichtian are present. Thus in Mangyshlak the whole of the Upper Maastrichtian is represented by a Zone of *Belemnella kazimiroviensis* (NAIDIN, 1973).

It is still necessary to go to the original paper (NAIDIN, 1973) for full details, although some of the taxonomy has been modified. For more recent views set in the context of the whole European - central Asian region see CHRISTENSEN (1996, 1997 a, b).

Regional studies

Alongside these studies on belemnites, Naidin has developed a broad picture of Upper Cretaceous geology. This was seen from his first papers in English (1959, 1960a), through other papers published in the west (1979, 1981b; NAIDIN & VOLKOV, 1998). Amongst those publications in Russia have been NAIDIN & PETRENKO (1961), GERASIMOV *et al.* (1962), PAPULOV & NAIDIN (1979), NAIDIN & ALEKSEEV (1980), NAIDIN *et* al. (1986); and as one of the authors of the standard work on the Cretaceous system in Russia edited by MOSKVIN, 1986-87. These studies continue, e.g. JOLKICHEV & NAIDIN (1998).

If Dmitri Naidin had done no other research, these belemnite and regional studies would still have placed him as one of the leading Russian geologists in the second half of the 20th century. In fact, he has been a leader in several other fields of Cretaceous studies.

Sea-level changes

All Naidin's accounts of regional geology and palaeogeography have been related first to transgressions and regressions, and then to eustatic changes of sea-level. Earlier work was very generalised (e.g. NAIDIN, 1971, 1972b, 1976b) , but by 1980 he led a team which produced curves

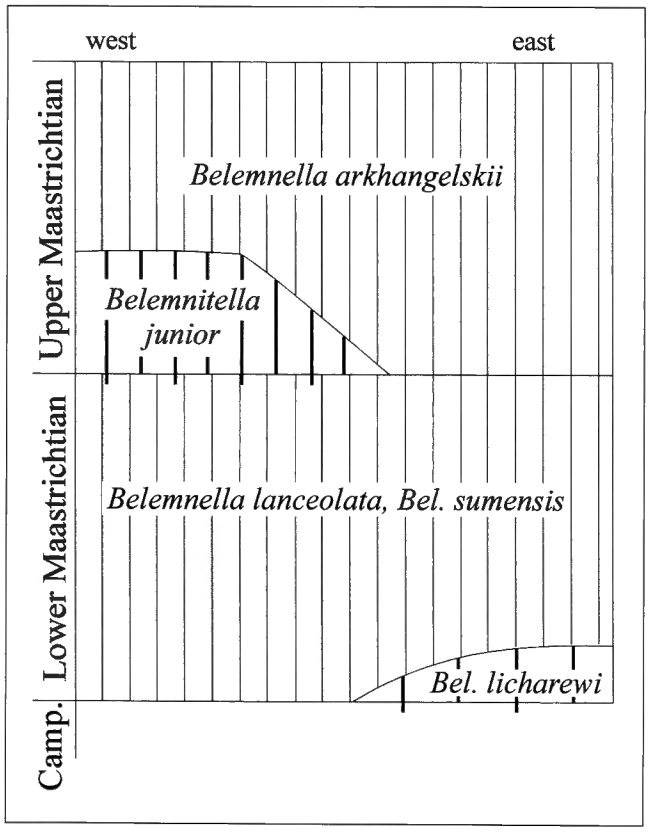

Fig. 1 — Copy of fig. 5 from NAIDIN (1973), re-drawn for this paper with anglicisation of cyrillic script. *Belemnella arkhangelskii* is now known to be a junior synonym of *Belemnella kazimiroviensis* Skolozdrowna.
This figure is one of Naidin's early diagrams to show that some belemnite species have different stratigraphical ranges in different regions. The original caption (in Russian) reads: Biozones and teilzones of Maastrichtian belemnites in the Western (western Europe, Poland, western region of the Ukraine) and the Eastern European palaeogeographical region.

on a stage-by-stage scale for eight regions of the USSR (NAIDIN *et al.*, 1980 a, b). In the 1980's he paid particular attention to Kazakhstan (NAIDIN *et al.*, 1982, 1984): this showed some startling differences from the curves for western Europe and the USA (but see MARCINOWSKI *et al.*, 1996).

In his most recent work (NAIDIN & VOLKOV, 1998) he re-affirms his belief in eustasy, which he thinks is controlled by increases and decreases in the total volume of water in the oceans. He also emphasises that many sedimentological phenomena are affected by epeirogeny and climate. In spite of the stability of the "East European Platform", (which comprises both the Russian Platform and its extension westwards through north Poland, north Germany and southern Scandinavia), there are local regions where tectonism rules over eustasy (see NAIDIN *et al.*, 1980b, fig. 10). He supports the EXXON school in their theories of coastal-onlap but does not believe that the EXXON curve is applicable to the East European Platform; and, like others before him, complains that the biostratigraphical correlations in the EXXON chart are inadequate to use their eustatic changes for correlation.

Geochemistry and general studies

Unusually in a scientific world of ever increasing specialisation, Naidin, having started as a palaeontologist, has encouraged the use of every technique to improve the overall picture of Cretaceous geology.

He has paid special attention to isotope geology for palaeotemperatures (NAIDIN, 1972a; TEIS & NAIDIN, 1973; TEIS, NAIDIN & STOYANOVA-VERGILOVA, 1975). VOLKOV & NAIDIN (1994, 1998) have attempted to reconstruct trade-winds and marine currents for much of the Late Cretaceous for the whole world. Naidin has also contributed a view on the geochronology of the Cretaceous period (NAIDIN, 1981a, 1982). He has adopted a cautious approach, not even offering his own table of dates.

Geochemistry has also been applied to his studies of the K/T boundary (see NAIDIN, 1997).

Cretaceous-Tertiary boundary

There are valuable K/T boundary sections in the Crimea, in the Kopet-Dag, straddling the border between Turkmenia and Iran, and in Mangyshlak in western Kazakhstan. The section at Koshak (44° 36.55' N; 51° 46.50' E) in particular, is accessible, free of vegetation, unlikely to be built over, contains echinoids, belemnites, ammonites, foraminifera, calcareous nannoplankton and an iridium anomaly: in many respects it would be a better global boundary stratotype and section point than El Kef, but when the international vote was taken, the Mangyshlak region was closed to non-Soviet citizens.

A valuable aspect of Naidin's research is that from the earliest papers (e.g. NAIDIN, 1960; MOSKVIN & NAIDIN, 1960) has been that he has not just concentrated on late Cretaceous extinctions but has considered the survivors into the Palaeogene, and investigated the appearance of new taxa. It was this broad view of the faunal changes that led him early in his researches to assign the Danian to the Tertiary and put the K/T boundary on the top of the Maastrichtian.

Naidin's most complete discussion of his earlier views is in his 1976a paper, but see also NAIDIN (1978). The Danian sediments of the Crimea are described in NAIDIN (1964c) and more recently by NAIDIN & BENJAMOVSKY (1994). The Maastrichtian sections in Mangyshlak are described in NAIDIN, BENJAMOVSKY & KOPAEVICH (1984).

In 1997 he distinguished two types of boundary sections in Mangyshlak: those with boundary clays, which contain Ir enrichment in the basal few mm of the clay, e.g. Koshak and Kyzylsai; and those with a hardground on top of the Maastrichtian, e.g. Aksyirtau (NAIDIN, 1997). For discussions in English, see NAIDIN (1987, 1996).

Politics

There are many innocent people, even some scientists, who believe that science is independent of politics. No discussion of Naidin's work is possible without taking politics into account. As Isaiah Berlin has written, "... despite every effort to separate them, conducted by a blind scholastic pedantry, politics has remained indissolubly intertwined with every other form of philosophical enquiry." (BERLIN, 1997, p. 192). By now there is a generation which has never known the stupid distortions of knowledge and understanding during the cold war, let alone the extremes of thought-control during and immediately after the Great Patriotic War. The isolation of Russia from western Europe and North America, and the isolation of North America and western Europe from Russia are already becoming difficult to visualise, but the differences of language merely made the separation easier: ignorance could be excused.

The degree of isolation between east and west is well illustrated by two standard works on sediments: PETTIJOHN (1957) and STRAKHOV (1962). The American work discusses the formation of clastic rocks in terms of both physics and chemistry, but it is the tectonic milieu which dominates the control on facies. ". . although sedimentation... is affected by many factors, the most fundamental is tectonics" (PETTIJOHN, 1957, p. 638). Much of this relationship between facies and tectonics is discussed in terms of "the geosynclinal cycle".

In STRAKHOV's giant work it is difficult to find a mention of geosynclines. Although he recognises a tectonic factor in the distribution of facies, the dominant control is climate. Indeed, volume 2 is on the formation of sedimentary rocks in humid climates, volume 3 on their formation in arid climates. For the Russian author the greater importance of climate was concluded after consideration of both hypotheses: American publications on tectonic controls are quoted but their conclusions are rejected.

For the American author, literature in Russian does not exist. A striking example of this is provided by the description of the Black Sea sediments. The latest and only example of Russian work which PETTIJOHN quotes is a paper in French by ANDROUSSOW published in 1897; no mention at all of the more recent Russian work, including that by STRAKHOV himself.

Naidin recognised the need to get information to geologists outside the Soviet block of research being done in the USSR and eastern Europe. And to get western geologists to visit the USSR to see what research was being done there. But this is to jump forward. At first it was a matter of developing his career inside the USSR.

If he had avoided politics until he had left the army, Dmitri could hardly have avoided them as a geologist. From 1946-49 he worked on the Upper Cretaceous stratigraphy of western Ukraine around Lwow, Drohobyoz, Stranislawow and Tarnopol. This was not just a matter of a few brief visits. He himself was concentrating on the belemnites, but he also collected the inoceramids on which Dobrov based his work, the echinoids used by Moskvin, some of the ammonites studied by Mikhailov, and the material for various authors on the foraminifera. He also worked on material in the museum at the University of Lwow. In other words, he must have spent a lot of time in western Ukraine.

During those years western Ukraine was still in a state of violent turmoil. As someone who had become a member of the Communist Party during the war yet had a Ukrainian father, Dmitri was able to move in all sections of society. Nonetheless, he must have learnt a great deal of the political skills needed to work within the Soviet system at that time.

Stalin died in 1953. Whilst he was alive any contact with foreigners would have been foolhardy. By 1955 Naidin was in an established position in Soviet society, a party member for more than ten years, working in a subject of limited political significance at the premier All Soviet university (MGU). He started sending offprints, writing letters and exchanging specimens with that most lovable of western geologists, Ehrhard Voigt (University of Hamburg), who had himself been an enterprising prisoner of war in the Soviet Union. In 1958 Naidin submitted a paper to Ivar Hessland for publication in the Stockholm Contributions in Geology (NAIDIN, 1959). We now know that the Swedish socialist government maintained very close relationships with the USSR through the cold war (Richard Reyment, personal communication). Around the same time Naidin started corresponding with Willy Wright and Jake Hancock in England.

In 1960-61 Richard Reyment was able to visit Moscow and Leningrad; in 1963 Voigt was a guest, not only in Moscow but also in the university "baza" (= field centre) near Bakhchisarai in the Crimea. Arising from these contacts came the quantitative study of *Actinocamax verus* (REYMENT & NAIDIN, 1962); and a monograph on Upper Cretaceous Bryozoa from the European part of the USSR (VOIGT, 1962); followed by a similar survey of the Bryozoa from the south Asian republics of the USSR, with the help of both Naidin and Ashot Atabekian (Leningrad) (VOIGT, 1967).

Thus Naidin gradually built up contacts between east and west. Over the years this became slightly easier, but it is difficult now to comprehend the courage which was needed during the cold war. Relationships within the eastern block were more complicated than it may have appeared. Even in the so-called free west, commu-

nication with the USSR was often regarded with suspicion and sometimes impossible if you were a government employee.

Naidin has contributed to the improvement of geological relations between east and west in a variety of ways. First, I would put the dissemination of Russian literature to western geologists.

He has sent out copies not just of his own works but of many Russian geologists, either by persuading them to write to us, or by obtaining copies of their papers and monographs to send himself. Whereas some of the atlases of fossils of the 1950's to 1970's were produced in editions of 1,400 to 2,000 copies, in the 1980's numbers went down to 600-800 copies. The number of spare copies must be very small. For some papers there is now a print-run of only 400 copies.

There was also the dissemination of ideas from the west into the USSR. He was responsible for the introduction of several developments of western research to other geologists in Russia, e.g. the concept of hardgrounds in chalk successions, and the use of quantitative measurements in palaeontology.

In the 1970's Russian geologists started to appear at Cretaceous symposia in the west. Here one must pay tribute not only to Naidin, but to Richard Reyment with his IGCP Project on MidCretaceous Events; to Tove Birkelund for the meetings she organised in Copenhagen; and to Jost Wiedmann for his International Cretaceous Symposia.

Fourthly, have been visits of western geologists to Cretaceous regions in the former Soviet Union. The craziness of the old Soviet system is nowhere better illustrated than the difficulties Naidin had in getting geologists to the Mangyshlak hills on the eastern side of the northern Caspian Sea. It has been known for many years that the hills there contain fabulous Cretaceous sections. So long as the Soviet Union existed the region was totally closed to non-Soviet citizens, even for party members from other east European countries. Dmitri tried repeatedly to get permission to take geologists there, without success. It was only with the independence of Kazakhstan that he was able to lead western geologists into Mangyshlak in 1994. On the ground there seemed to be no reason why foreigners should have been excluded.

One of my many good memories of Dmitri Naidin is at the international meeting on the K/T boundary held in Copenhagen in 1979. He explained that it was the official line in the Soviet Union that the Danian was part of the Cretaceous system, but he didn't believe that the Russians should ignore what the rest of the world had discovered and for him the boundary should be placed at the top of the Maastrichtian stage. By 1984 he had succeeded in changing the view of the Interdepartmental Stratigraphic Committee of the USSR which then came into line with international opinion.

If Dmitri Naidin's most important contribution in the history of geology has been the building of good relations between east and west, we should remember that this was only possible because of that impressive body of published research, of which the outline given above is far from a complete survey. It has been his catholic approach which has ensured the respect of a broad body of geologists.

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