Paleo-piracy endangers Vendian (Ediacaran) fossils in the White Sea - Arkhangelsk region of Russia

[Les prélèvements sauvages, une menace pour les fossiles vendiens (édiacariens) de la région de la Mer Blanche - Arkhangelsk en Russie]

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Abstract: The world-famous Vendian (Ediacaran) fossil biota in the White Sea - Arkhangelsk region of Russia contains some of the most exquisite fossils of the earliest macrobiota (560-545 million years old) on Earth. Over 600m of continuously fossiliferous strata consisting of fine sand, silt and mud crop out at many localities along the White Sea. The fossils have been under study for decades in Moscow and that work continues. These fossils represent unusual taxa of early metazoans, algae, microbial mats, and strange sedimentary impressions that represent a very early stage of development of animals on Earth.

These unique fossils have been well publicized through exhibitions, newspaper articles, scientific research papers and various web sites. As a result and in spite of their remote location, they are endangered by unauthorized fossil collectors. These paleo-pirates violate local and national laws, destroy fossils and fossil sites, and leave debris and garbage in the area. Some scientific papers are, surprisingly, based on illegally-collected fossils. Other illegal fossils have been offered for sale by commercial fossil dealers, chiefly at meetings or through web purchases.

Paleo-piracy of the Vendian biota must be stopped. The collection of fossils has been illegal since February 2000 by the authority of the Administration of the Arkhangelsk Region and the Northern Committee of Natural Resources of the Russian Ministry of Natural Resources. Presently, the Ministry of Internal Affairs and Federal Security Service are prepared to protect the Vendian localities by arresting pirates. Recommendations to control paleo-piracy in the White Sea region include finalizing the establishment of World Heritage Site status, educating the local people in the values of the fossils and the need for their protection, establishment of a procedure for licensing for the collection of some fossils, and the notification to sellers of Vendian material by Russian authorities that the fossils were obtained illegally and hence are the property of Russia.

Key Words: Vendian; Ediacaran; paleo-piracy; paleontological resources; destruction; selling fossils.

Résumé : ***Les prélèvements sauvages, une menace pour les fossiles vendiens (édiacariens) de la région de la Mer Blanche - Arkhangelsk en Russie*.-** Les sites vendiens de la Mer Blanche -

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Arkhangelsk (Russie) sont mondialement connus. Ils recèlent quelques uns des plus beaux exemplaires connus de macrofossiles primitifs des temps édiacariens (560 - 545 Ma). La série fossilifère est formée de grès fins, de pélites et d'argiles. Elle s'étend sur un une épaisseur de près de 600 m. Elle affleure en diverses localités réparties le long des côtes de la Mer Blanche et depuis des dizaines d'années, des laboratoires moscovites se sont attachés à son étude. On y rencontre des taxons rares de métazoaires primitifs, des algues, des tapis microbiens et des empreintes énigmatiques qui représentent un état très primitif du développement de la vie terrestre.

Ces fossiles exceptionnels ont été popularisés lors d'expositions, par la publication d'articles scientifiques et le montage de sites internet. Un des effets de cette publicité est, que malgré leur difficulté d'accès, les gisements sont l'objet de prélèvements non autorisés. Ces paléopirates, violent les lois locales et internationales, détruisent et souillent les gîtes de leurs déchets. D'une façon surprenante on constate que certains articles scientifiques sont basés sur ces récoltes clandestines qui alimentent également des circuits commerciaux directs ou par le biais d'Internet.

Il importe d'arrêter ces pillages. Un arrêté pris en 2000 par le Northern Committee of Natural Ressources qui dépend du Ministère des Ressources Naturelles, rend ces actions illégales. Actuellement, le Ministère de l'Intérieur et les services fédéraux de sécurité, prévoient d'aller jusqu'à l'arrestation des contrevenants. Les dispositions pour réduire ces prélèvement sauvages comprennent en plus : 1) l'inscription des sites au titre du patrimoine mondial, 2) l'information des populations locales sur la valeur des fossiles et la nécessité de les protéger, 3) la mise sur pied de procédures d'autorisation de prélèvement et enfin, 4) une information à destination des vendeurs de matériel récolté hors du cadre légal, leur signifiant que celui-ci demeure propriété de la Russie.

Mots-Clefs : Vendien ; Édiacaren ; prélèvements sauvages ; ressources paléontologiques ; destruction ; commerce des fossiles.

1. Introduction

The Ediacaran biota of the Vendian strata in the White Sea-Arkhangelsk region of Russia contains representatives of algae, microbial mats and the first animals (Figs. 1-6) that date between 560 and 545 million years ago (FEDONKIN, 1992). The animals are among the oldest known species in the world (FEDONKIN, 2001), and the localities come from are some of the finest in the world because of their preservation in fine-grained sedimentary rocks (Fig. 7) and because they occur throughout a sequence that represents one of the longest in the world. These localities were only discovered in the 1970s (FEDONKIN, 1978), and are still under intensive study. However they are in danger of being destroyed by illegal collectors (IVANTSOV, 2001). These collectors violate local and national laws, destroy fossils and fossil sites, and leave debris and garbage near the sites. Herein we report on these illegal activities and propose some solutions to the practice.

2. The Vendian biota

The first wide expansion of metazoans in the history of the Earth occurred in the Ediacaran (Vendian) (650-542 Ma). In the Late Ediacaran, diverse organisms occupied the seas of all continents (none are yet known from Antarctica) from the tropics to the boreal regions and from deep to shallow or even intertidal waters. However, these were peculiar organisms (Figs. 1-6) that differed considerably not only from modern animals, but also from those of the Cambrian that immediately followed the Ediacaran. To some extent their study can be compared to a study of extinct life of some other planet. Only through studying fossil remains can we understand how this life was organized, which factors determined its global expansion and evolution, and what caused its disappearance (if that has occurred).

The most extensive localities containing the remains of Ediacaran metazoans are found in South Australia, Namibia, Canada, and European Russia. However, the best are those in the White Sea-Arkhangelsk Region, Russia, for many reasons. The rock sequence is known as the Vendian (= Ediacaran) in this region. The fine-grained structure and high proportion of clay of these rocks preserve the finest details in the fossils (Fig. 7). Most fossils are preserved as impressions and casts. The rock is so soft that the fossils can easily be collected and prepared, or even taken apart manually, enabling the study of the internal structure of these ancient fossils. A high diversity of the fossils, the presence of species known from localities in Australia, Namibia, Canada, England, Northern Yakutia, and species found only in the Arkhangelsk region facilitates paleontological, biostratigraphic, and other studies impossible to perform based on fossils from other places in the world (FEDONKIN, 1992; IVANTSOV & FEDONKIN, 2001; IVANTSOV & MALAKHOVSKAYA, 2002; IVANTSOV *et alii*, 2005).

The distribution of fossils throughout the entire thickness of the Upper Vendian rocks (this thickness reaches ±1 km in the Arkhangelsk region) and the latest isotope dating allow the study of trends and rates of evolution of organisms in the Late Vendian and may allow biostratigraphic subdivision of these beds. These topics are priority tasks for science both in Russia and abroad. In Arkhangelsk region, Late Vendian rocks are exposed at the surface, generally in coastal cliffs (Fig. 8) or rivers valleys (Fig. 9), over an area about 350 km long and 250 km wide bordered to the north and west by the southeast coast of the White Sea, on the south by the middle reaches of the Onega River, and on the east by the mouth of the Pinega River (GALIMZYANOV & MALYUTIN, 2000). The Upper Vendian beds are mainly represented here by green silt, shale, and sandstone, all weakly lithified (Fig. 10).

The remains of the metazoans are preserved as impressions on the bedding planes of sandstone or siltstone, or inside the more or less thick lenses of massive or slightly bedded sandstone (IVANTSOV & MALAKHOVSKAYA, 2002). The presence of biogenic surfaces, surfaces produced by microbial mats, covering large areas of the bottom of the Vendian sea, is an important indicator of fossils. The first localities of the Vendian fossils in the Arkhangelsk Region were found in 1972 through 1977 by a group of geologists from the Geological Institute, Russian Academy of Sciences, Moscow, led by B.M. KELLER (KELLER *et alii*, 1974; KELLER & FEDONKIN, 1976; FEDONKIN, 1978). Most subsequent research in this region was conducted by the Laboratory of Precambrian Paleontology (currently Laboratory of Precambrian Organisms) organized by Academician B.S. SOKOLOV in the Paleontological Institute, Russian Academy of Sciences, also in Moscow. In the last thirty years, the following localities were recorded in the Arkhangelsk Region: Lyamtsa, Agma, Syuzma, Karakhta, Solza, Zimnie Gory, and Yarnema (STANKOVSKY, 1997; STANKOVSKY & FEDONKIN, 2000; IVANTSOV *et alii*, 2005). Each of these localities provided the material for world-class discoveries. Among the most interesting recent discoveries are large, even huge, specimens of Vendian animals (0.5 m and longer), and the traces of feeding and movement of these animals (IVANTSOV & MALAKHOVSKAYA, 2002), the latter being a landmark in the study of the nature of the Vendian animals. These animals were capable of fast movement, and could collect food particles, *i.e.* they belonged to the kingdom Animalia (IVANTSOV & FEDONKIN, 2001; IVANTSOV & MALAKHOVSKAYA, 2002).

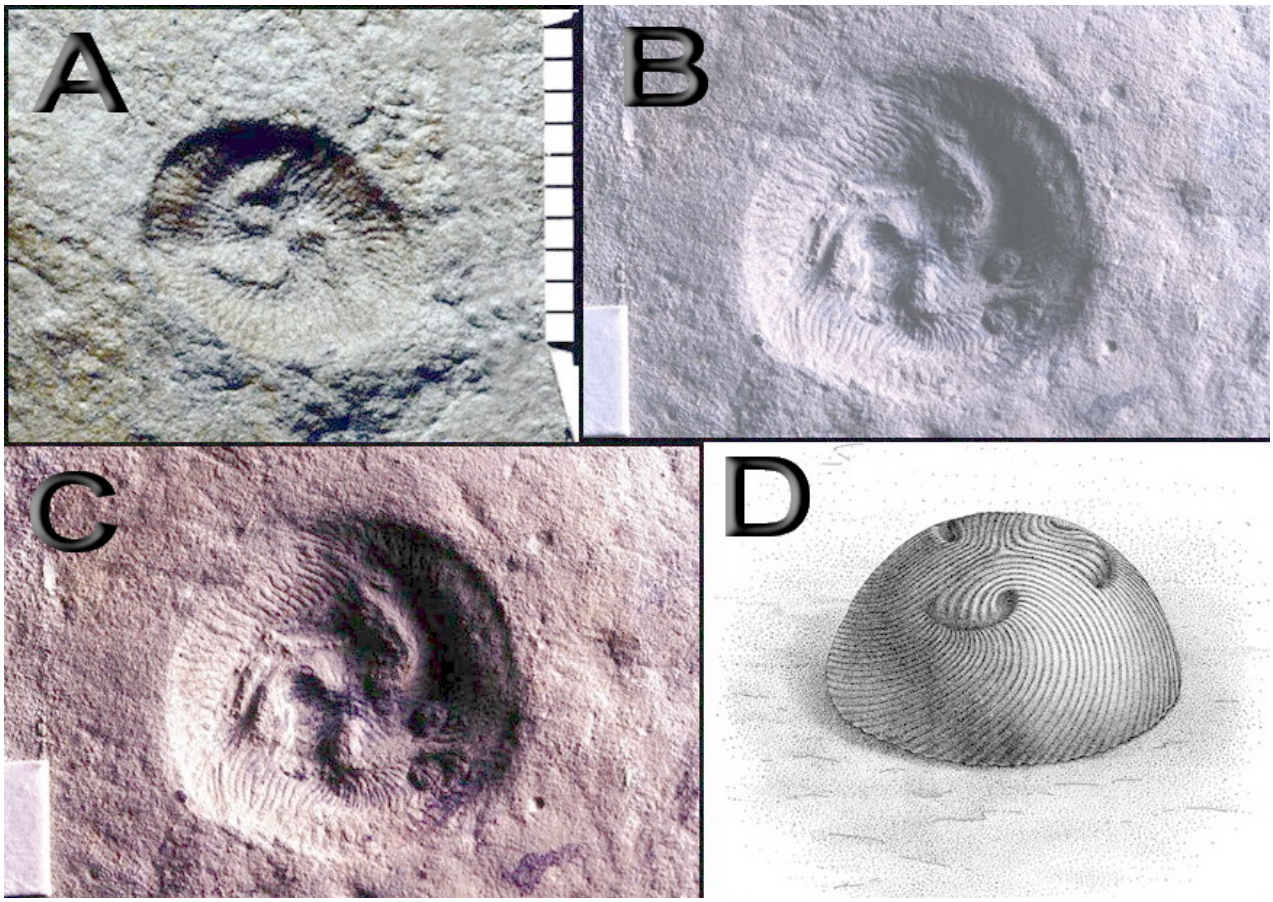

Figure 1: Fossils from the Vendian strata in the White Sea-Arkhangelsk region, Russia. The benthic suspension-feeding *Tribrachidium heraldicum*: A, B, C. Specimens from the White Sea outcrops. Scale in mm. D. A reconstruction of *T. heraldicum* living on the sea floor.

3. Paleo-Piracy: The illicit collecting of Vendian fossils

The results of the study of the Vendian metazoans from the Arkhangelsk Region were published in numerous scientific and papers and monographs (see URL: http://www.vend.paleo.ru/), and have been repeatedly reported in the newspapers and semi-popular articles (e.g., see the newspaper *Izvestiya* for 10.01.02, 20.05.03, 17.06.03). Some of the Vendian finds have been exhibited in the geological, paleontological and natural history museums in Moscow, St. Petersburg, Arkhangelsk, and elsewhere, as well as displayed in temporary exhibitions such as *Dawn of Life* and *Conquerors of the Earth* that were displayed in many Russian towns. Web sites have prominently displayed Vendian data and organisms (URL: http://www.ucmp.berkeley.edu/vendian/vendian.html).

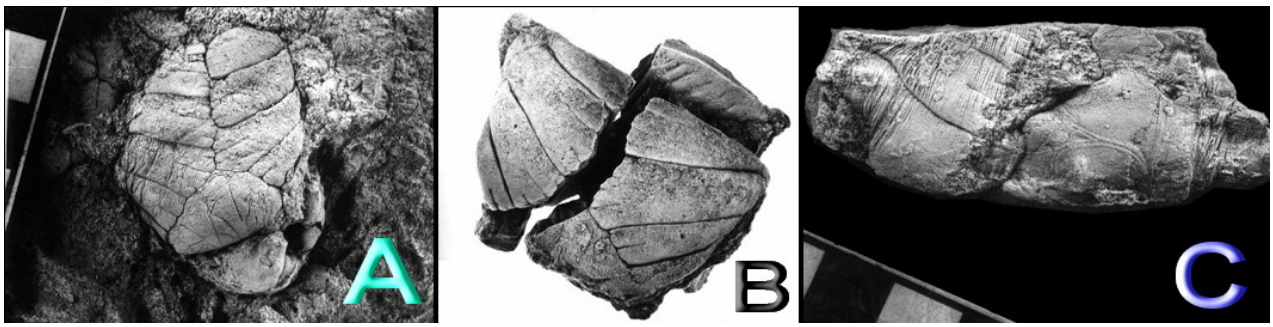

Figure 2: Fossils from the Vendian strata in the White Sea-Arkhangelsk region, Russia. The unusual fossil *Ventogyrus chistyakovi:* A, B. External molds; C. Internal mold showing impressions of circulatory structures.

Figure 3: Fossils from the Vendian strata in the White Sea-Arkhangelsk region, Russia. *Yorgia*.

Unfortunately, the wide distribution of this information about the fossils caused a significant increase in illegal activities of private and commercial fossil collectors (Fig. 11). The potential value of their activity (discovery of new outcrops or previously unrecorded occurrences of impressions) is greatly outweighed by the cost (impoverishment of localities, depletion of small occurrences, destruction of host rocks, loss of valuable geological data, a great decrease in the probability of discoveries of rare fossil species, and the mess they have left (Fig. 12)). Impressions of organisms unknown to science from Zimnie Gory and Suzma localities were reportedly sold at geological fairs in Germany and America and acquired by geological museums in Europe (Fedonkin, 2001). Scientific papers have even been published based on illegal material collected from the Arkhangelsk Region (Steiner & Reitner, 2001; Reitner & Worheide, 2002; Zhang & Reitner, 2006). Many of the fossils are sold by at least one US company advertising itself on

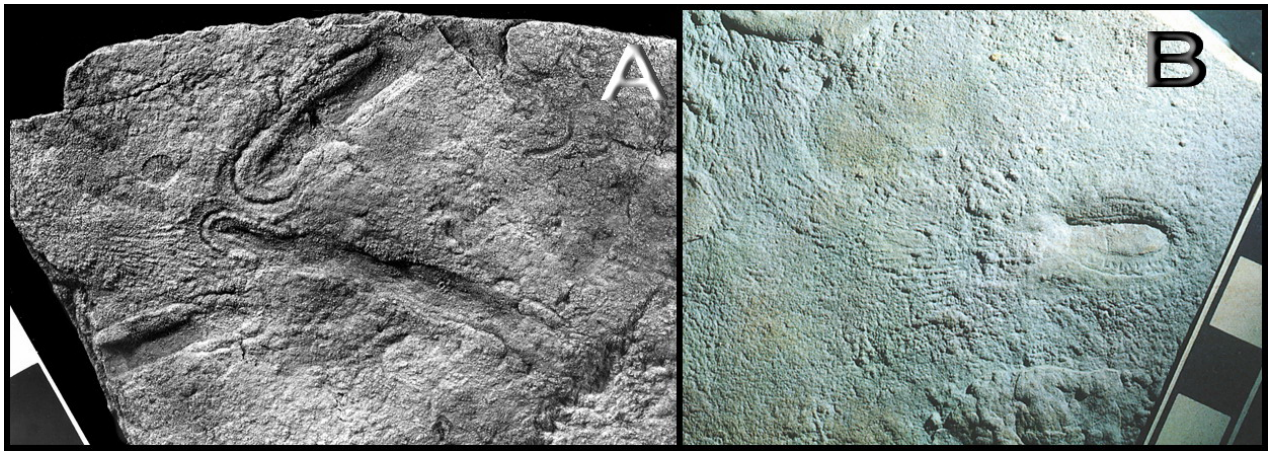

Figure 4: Fossils from the Vendian strata in the White Sea-Arkhangelsk region, Russia. *Kimberella:* A. A group of three *Kimberella.* B. *Kimberella* specimens with scratch marks made by the living animal on the surface of a microbial mat. Scale bars in cm.

the web (see URL: http://www.thenaturalcanvas.com/Softbodied/index.html). These kinds of activities are illegal and forbidden by Russian and local law. Apparently, nothing stops paleo-pirates from taking illegally-collected impressions of the Vendian organisms outside Russia.

Impressions of Vendian metazoans in the rocks are very rare. The beds are in most cases paleontologically barren, and contain no soft-bodied remains and the fossils are usually concentrated in relatively dense, but not very common, accumulations. Each of these is unique, always containing several species that are restricted to the accumulation. Such accumulations are not more than several tens of meters along the strike of an outcrop and can

be depleted during one field season. However, arguments about the uniqueness of the localities, each one often the only one of its kind on the whole of the Earth, do not stop private collectors.

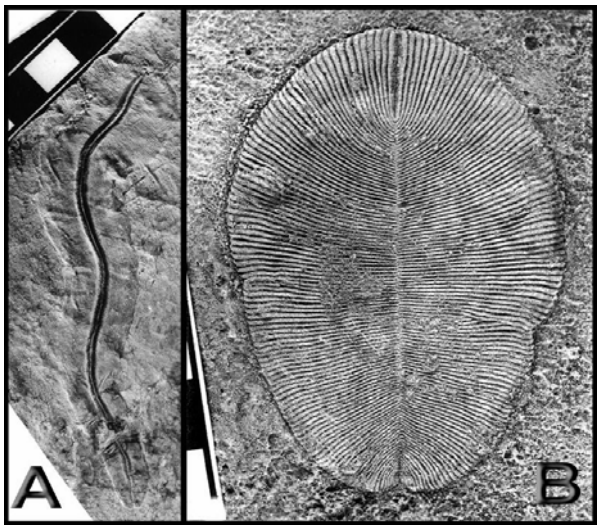

Figure 5: Fossils from the Vendian strata in the White Sea-Arkhangelsk region, Russia. *Dickinsonia:* A. *Dickinsonia lissa.* B. *Dickinsonia* sp. Scale bars in cm.

Figure 6: Fossils from the Vendian strata in the White Sea-Arkhangelsk region, Russia. The unusual bag-like impression of *Andiva ivantsovi.* Scale bar in cm.

In 2005-2006, illicit digging of Vendian metazoans in the Arkhangelsk region became massive. The scale of one-time diggings by paleontological poachers in the Solza locality is striking. On one of the outcrops at this locality,

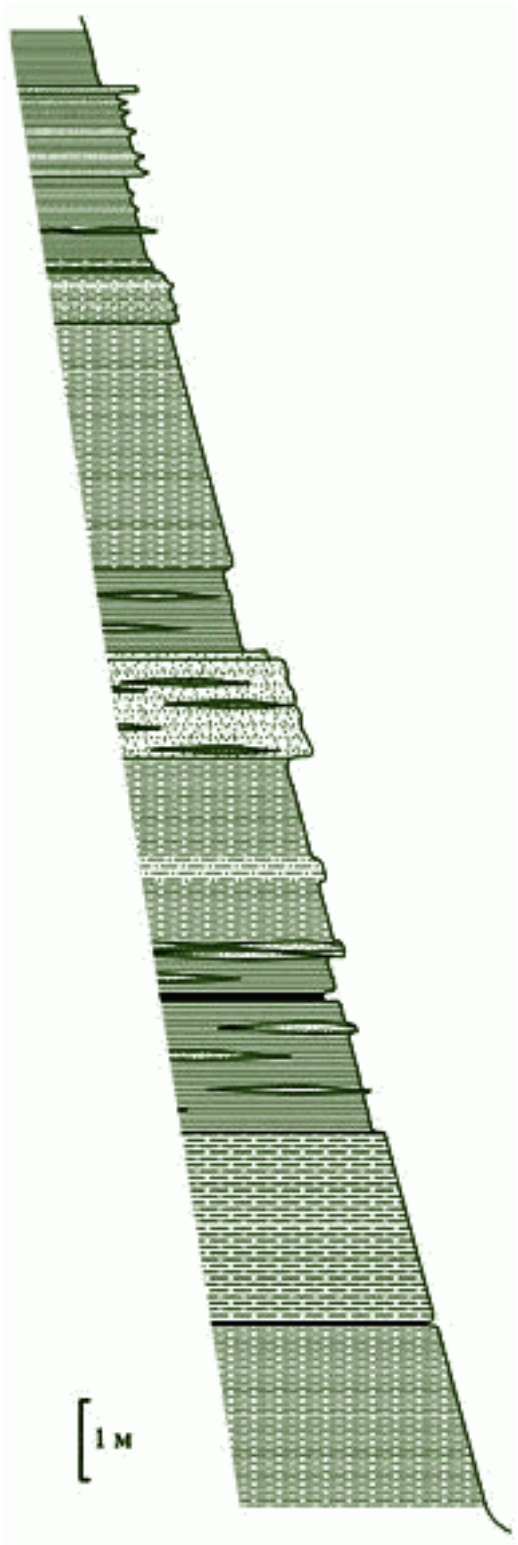

Figure 7: Typical Vendian stratigraphic sequence in the White Sea-Arkhangelsk region, Russia, showing weakly indurated fine sandstone, siltstone and mudstone layers. Some sandstones are lens-shaped, and may represent current deposits.

the diggers made excavations of 200 m^3, whereas the total area of the excavated surface with impressions exceeded 100 m^2 (for details see *Severnyi komsomolets*, 06 October, 2006, issue 57). Excavation on a similar scale in the

Yarnema, Syuzma, and Karakhta localities would lead to complete destruction of these localities during one season. The damage is not only being done to Russian science and the national prestige of the country which is allowed to be robbed unpunished, but also irreparable damage is done to world science, as the possibility of studying whole groups of the earliest fossils, found only in these unique localities, can be lost forever.

Figure 8: Coastal outcrops of Vendian strata in the White Sea-Arkhangelsk region, Russia.

Figure 9: Two typical views of river outcrops of Vendian strata in the White Sea-Arkhangelsk region, Russia.

4. Recommendations

The illicit excavation of Vendian fossils from the White Sea-Arkhangelsk region must stop. The geological community has for a long time been attempting to preserve the localities of the Vendian animals in the Arkhangelsk region (KARPUNIN *et alii*, 1998; OZHIGINA, 1999; STANKOVSKY, 2000; STANKOVSKY & FEDONKIN, 2000; IVANTSOV, 2001). Here we summarize current efforts and offer some other possibilities for the preservation and protection of the region's fossil sites.

The world precedent for protecting and preserving Ediacaran sites is very clear. All countries that have large sites containing significant impressions of Ediacaran metazoans (Australia, Namibia, and Canada) have forbidden commercial collecting and export of the impressions (see URL: http://www.spnhc.org/documents/fossilprotection.htm). The Administration of the Arkhangelsk Region and Northern Committee of Natural Reserves of the Ministry of Natural Resources of Russian Federation adopted a decree prohibiting paleontological collecting in the territory of the region (Decision of the Administration of the Arkhangelsk Region and Northern Committee of Natural Resources at the Ministry of Natural Resources of 14 February, 2000, n° 461 (GALIMZYANOV & MALYUTIN, 2000). On the initiative of these institutions, the Paleontological Institute produced a catalogue of the localities of the Vendian metazoans in the Arkhangelsk Region, with a detailed description of the most important fossil accumulations, and proposed recommendations for their preservation (IVANTSOV *et alii*, 2005). Regional organizations of Ministry of Internal Affairs and Federal Security Service are prepared to join forces to help protecting the localities of the Vendian animals (*Severnyi komsomolets*, n° 59 of 20 October, 2006), thereby setting a precedent for the preservation of Vendian metazoans in the Arkhangelsk Region.

The other localities elsewhere in the world have been given the status of national nature reserves, and geological or paleontological landmarks or parks. UNESCO coordinates and directs this work in the framework of the Program of GeoParks (see URL: http://www.unesco.org/science/earth/geoparks.shtml). A similar effort on behalf of the Vendian fossil localities in the White Sea-Arkhangelsk region should be undertaken as well. The next step, in our opinion, should be in granting the localities, indeed the entire region, of the Late Vendian metazoan impressions the status of a Paleontological Landmark of a regional and later of a federal and worldwide level. The paleontological resources of the White Sea-Arkhangelsk region are not the only natural features of value in the area. The biota of the White Sea, including beluga whales and other marine organisms and the Arctic forest environments, is also worthy of protection, forming the basis of a natural park of international significance. This action is long awaited by the world's scientific community, because only after the official status of the localities of the Vendian fauna is declared, can UNESCO begin the procedure of transferring them from the candidates for World Natural Landmark Sites (where they have been listed for over 20 years) to the actual Landmark status. This status should not exclude the possibility of scientific studies for the leading Academic institutions in Russia and of other human activities that would not harm the localities (FEDONKIN *et alii*, 2007). This includes education (for example, field trips for university students) and the ever-growing popular scientific tourism.

An effort to educate the local communities in the region about the importance of the sites should be initiated with the aim of developing in those communities the wherewithal to enforce the regulations of local and federal authorities, especially because those authorities are unable to protect the sites directly.

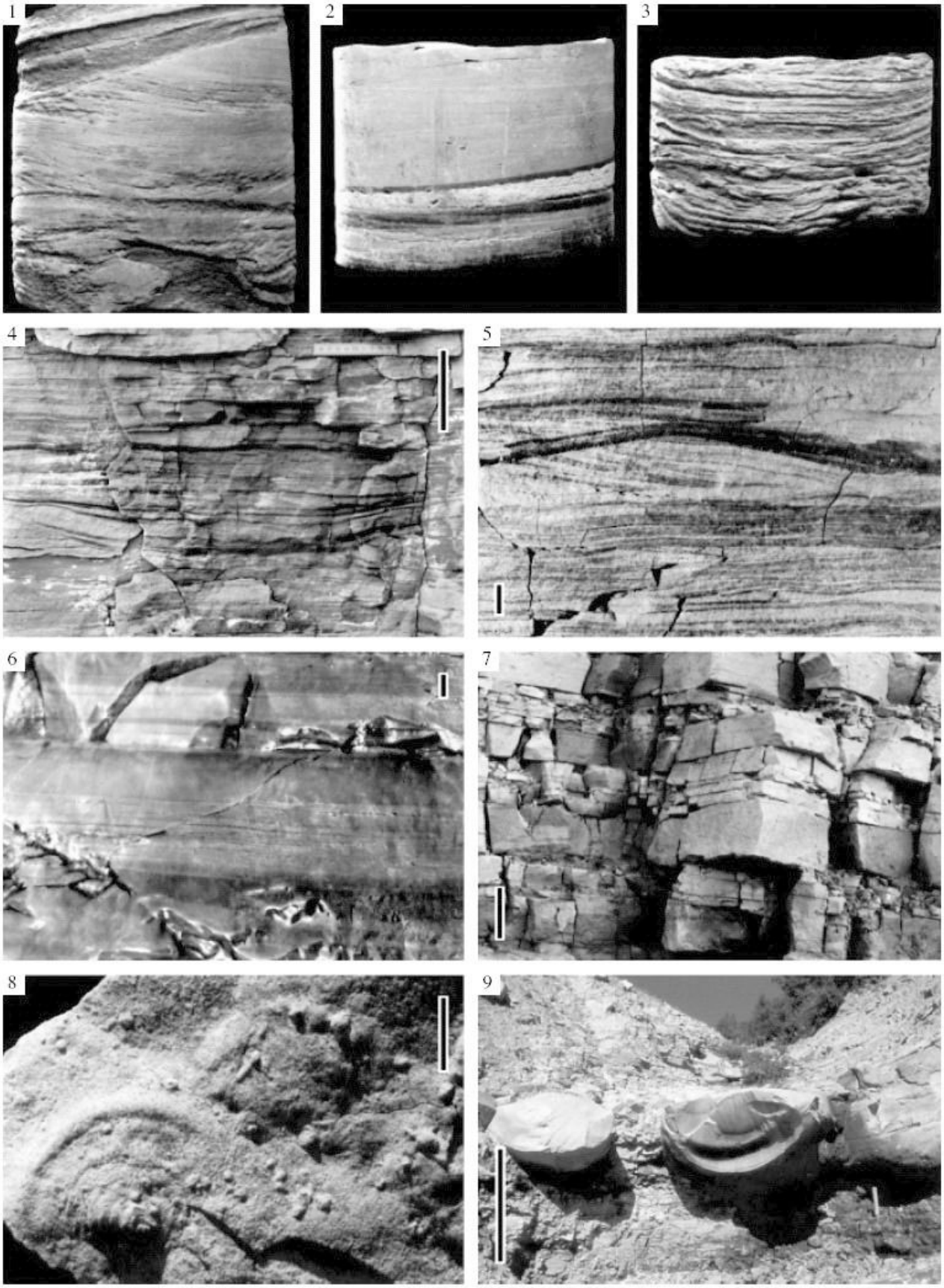

Figure 10: Sedimentary characteristics and structures from the Vendian strata in the White Sea-Arkhangelsk region, Russia.

Figure 11: Outcrops pillaged by paleo-pirates in the White Sea-Arkhangelsk region, Russia in 2006.

Figure 12: Trash left by paleo-pirates in the White Sea-Arkhangelsk region, Russia in 2007. A. Overview of site and trash. B. Close up of trash.

Perhaps a licensing process for the official collection of fossils might be advisable for amateur and professional collectors. Permits could be granted for a sum that could then help with the protection and conservation of the localities. Each permit would also entail an agreement to deposit scientifically-important specimens, determined by paleontologists, in the Paleontological Institute, Moscow.

The authorities of the Paleontological Institute and the local government should write to sellers of Vendian material that the fossils were obtained illegally and hence are the property of Russia.

The International Palaeontological Association (IPA) has designated the Vendian fossil localities in the region as a PaleoPark. IPA thus will provide support and expertise to protect and conserve the sites.

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