Dušan Hovorka, Danica Staššíková-Štukovská

Light mica in the grave (the 8–9th century) in Dubovany (Western Slovakia): site of its occurrence in nature

Dubovany is the small village located on the Trnava loess hilly country. Early Medieval (8–9th century) burial site is located in the oldest part of the Dubovany village, which area is from the most part still inhabited (Fig. 1A, B). The first grave from the burial place has been excavated by V. Budinský-Krička (1949), since the 1992 rescue field works are realised by the one of authors (D. S. Š.) of this contribution. Till now in Dubovany 44 graves have been surveyed, from which number 10 was of niche graves and the next 3 belonging to burial places with the only horses remains. The total areal extend of the burial place is not yet known. Some partly results dealing with archaeological aspects of the site were published by D. Staššíková-Štukovská (2004; 2005). General situation in the grave No. 11 in the whole have not been published yet. In this paper we concentrate our attention to the light mica, present in the given grave being the part of its outfit.

DESCRIPTION OF THE SITUATION IN THE GRAVE

Grave No. 11 was huge niche grave on the northern part of entrance pit oriented in the direction WNW – ESE. First field documention has been realised 6.9.1994 in the frame of a rescue survey. For the first time grave was observed 100 cm in depth from the present surface as light rectangle cover with oblong corners oriented in direction of WNW – ESE with dimension of 280 x 90 cm. It hase been studied using alongside and perpendicular sections. Shaft is filled up by loess and loess mixed with soil (earth).

The skeleton of a man in the age of *senilis* (antropological determinaton realised by Assoc. Prof. RNDr. A. Vondráková CSc. and RNDr. B. Kolena PhD (UKF Nitra) was deposited in the niche, originally in the wooden box, from which only negative prints with documented activity of wood fungi

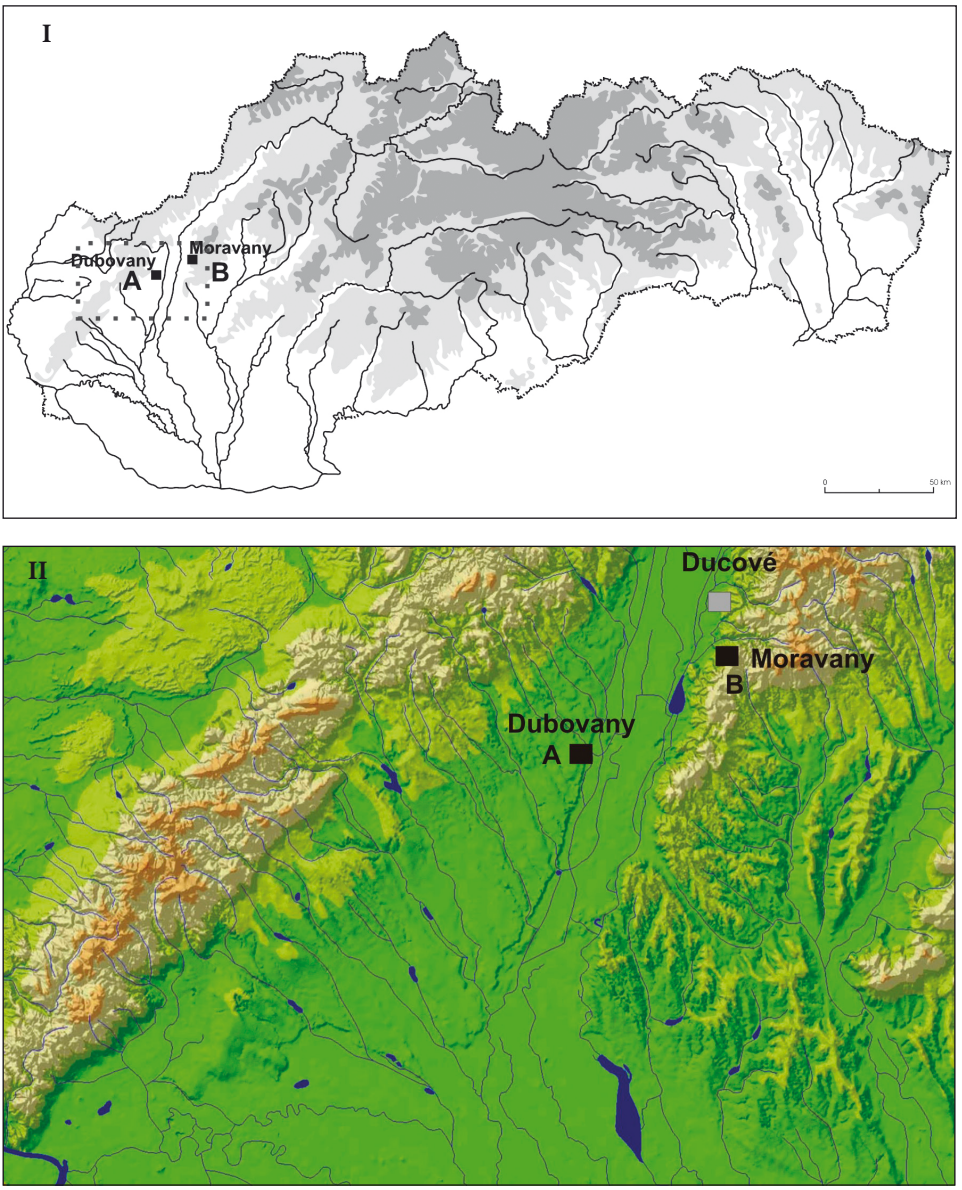

Fig. 1. I – Location of grave studied (A) and supposed place of the mica occurrence (B) – the Moravany nad Váhom pegmatite body. II – Detail of the microregion from geographic point of view and with localisation of most important centre from 9th century Ducove, near the Moravany on the river Váh.

Ryc. 1. I – lokalizacja opisywanego grobu (A) i przypuszczalnego miejsca pozyskiwania miki (B) – złoża pegmatytu w miejscowości Moravany nad Váhom. II – mikroregion osadniczy z lokalizacją najważniejszego stanowiska z IX w. n.e. Ducove w pobliżu miejscowości Moravany nad Váhom.

are preserved. Skeleton is destroyed, which process acted namely in the upper half of the trunk inclusive the cranium and pelvis. Legs were survived more complete with the exception of femur epophysis. Cranium as well as lower parts of limbs were engaged to hollows, which originated by decomposition of the wooden constructions. Upper limbs were originally situated along trunk, lower limbs were extremely tight each to the other. On the lower limbs an iron axe was deposited, iron part of it located on the fingers. In negative the position of original (wood ?) handle ending on the pelvis. The handle was 80 cm long, being 6 cm thick and narroving to the 2–2,3 cm in the axe fixing hole is observable. The outfit of the burried man was rich: sword, spurs, axe, flint, switchblade knife, knife, accessories for shuting of spurs, handle – the most probaly having function of lash ornamented by colored metals and the other remnants of wares. The total dimensions of the grave = 285–300 x 210–235 cm, depth ´ = 250–280 cm. The proper grave dig = 285 x 210–235 cm, depth = 250 cm, niche = 110 x 280 cm, depth ´ = 256–280 cm. The dimensions of the wooden construction were interpreted from the caves and directions of rhisomorphs: 90–110 x 270 cm. Height = 60 cm.

MODE OF WHITE MICA OCCURRENCE IN THE GRAVE

White mica in the studied grave was located over the finger phalanxes of the right as well as left limbs. White mica appeared in the form of large (till 3 cm in diameter) crystals which ware observable after the decomposition of niche construction. In observed concentrations of white mica no changes documented by the different coloring of individual mica leaves were documented (Fig. 2). Mica leaves covered the all finger phalanxes, forming the elipsoidal area with dimension of 10 x 8 cm. Which deals with the left limb mica leaves covered third-fifth finger phalanxes and the sword, it means area of 5 x 20 cm dimension. In both cases mica leaves were mixed up with the decomposed remains of the fingers and pelvis in the layer of 30 mm thickness. Individual mica sheets were not placed in identical vertical levels – they were mixed togeher with the loess and soil (Fig. 2 A, B). We consider that originally mica sheets were concentrated approximately in the central part of the given area. Postdepositional processes cause redistribution of the mica sheets and decomposition of bones, and probably also the shift of individual mica sheets. We have collected mica sheets; it was impossible to pick up all amount of them, namely those of small dimensions.

A

B

C

Fig. 2. Dubovany, okr. Piešťany Hrob 11. A – Detail of grave filling with light mica from place of the finger phalanxes of left upper limb; B – Detail of grave filling with light mica from the place of the phalanxes of right upper limb; C – Detail of grave filling with no light mica from the left upper limb. *Foto D. Staššíková-Štukovská*. Ryc. 2. Dubovany, okr. Piešťany, grób nr 11. A – fragment grobu z widoczną jasną miką w pobliżu paliczków lewej ręki; B – fragment grobu z widoczną jasną miką w pobliżu paliczków prawej ręki; C – fragment grobu w okolicach lewej ręki bez widocznych śladów miki. *Fot. D. Staššíková-Štukovská*.

It is without any doubt that described accumulation of large white mica sheets in the discussed grave was consequence of its being the part of the grave outfit. Anoloque discovery in the early Middle Age grave in the central Europe is not known to the authors.

DEPOSITION OF MICA SHEETS IN THE GRAVE

Based on the mica original distribution in the grave it seems that post-depositional processes should changed them; original mica sheets were deformed and broken, partly redeposited and due to the activity of roots of plants they changed original spatial distribution. The most important is answer on the following question: in which form was mica putted in the grave,

or respectivelly, in which enclosed material it was located into the grave. So it is possibly that distributed mica sheets were deposited in the grave in the form of „thick" 2 mica crystals composed of manyfolds alternating very thin mica sheets. The following disintegration of such thick mica crystals should be the result of pressure after the filling of the niche grave and namely solifluction and the other processes which should be described under general meaning „weathering". In such way various dimension of mica sheets and their distribution in the areas 10 x 8 and 5 x 20 cm within a layer of the 3 cm thickness, is understable.

The other possibility is represented by idea that mica was deposited in the grave in the form of individual mica sheets taking into account that also in this case postdepositional changes acted. If we consider this type of implacement the following question originates: how were sheets of white mica implaced into the tomb? It ought to be underlined that individual mica sheets are extremely light, and in the case of their mooving they react on the static electricity and the air draught. If we assume that mica sheets were concentrated on some (wooden, made of cloth, leather a o.) base, the most probably wooden box should be considered which enabled easy manipulation and location in the grave. In such case we have take into consideration two such boxes of uneven size which were distributed on two places on the human body. In connection to this a question arose: why mica sheets didn´t formed stack of several milimetres thick, but they were spread in the area in the relatively thin layer. Also postdepositional processes should not distributed mica sheets to such form, which was arranged in the open grave. So variant of deposition of mica sheets in the bottom of a box cover, seems to be questionable.

In connection to above mentioned circumstances, together with mice sheets distribution in the room it appears also possibility of possible mica distribution on some organic mater, on which mica sheets should be atractive from the point of its glance and lustre. In such case sheets could be fixed, the most probably by organic glue, which technology should be observed on individual mica sheets. Any such prove we haven´t found in the grave.

The last possible alternative is distribution of mica sheets by their dredging in two limited areas. Taking into account easy fly of mica sheets, their possible fixation by the shroud in which the dead man was rolled in, eventually by stutting of box in which a dead man was deposited. For such deposition of the corp is documented by extremely narrow position of both

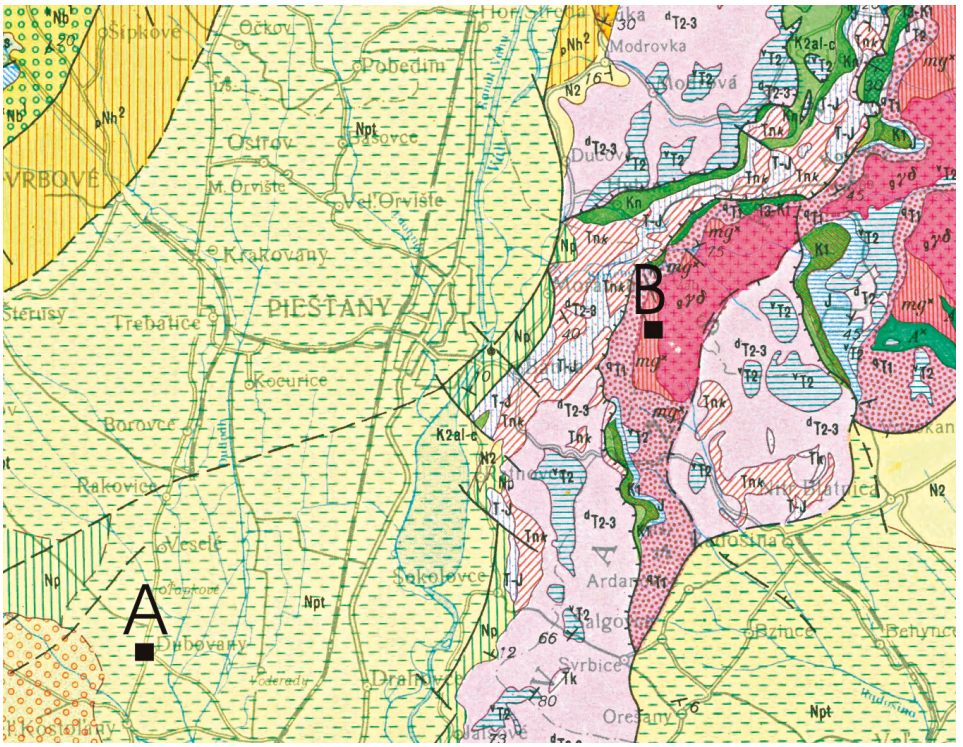

Fig. 3. Geological map of the area between grave in Dubovany (A) and place of pegmatite body (B). Various tints of yellow = Tertiary and Quaternary sedimentary formations; red = plutonite rocks of the granite clan; brown = metamorphic rocks of the gneiss family; deep green = amphibolite; light violet and light green = various Mesozoic sequences.

Ryc. 3. Mapa geologiczna obszaru pomiędzy grobem w Dubovanach (A) a złożami pegmatytu (B). Różne odcienie koloru żółtego = trzecio- i czwartorzędowe utwory osadowe; kolor czerwony = skały plutoniczne z grupy granitów; kolor brązowy = skały przeobrażone z rodziny gnejsów; kolor ciemnozielony = amfibolity; kolor fioletowy i jasnozielony = utwory mezozoiczne.

lower limbs. In the case when sheets of mica were located on upper limbs of the shroud just after its depositon in nook, also in this case mica sheets distribution in relatively thin (3 cm) layer though in the grave were observed postdepositional slides.

From the above mentioned possibilties we at the present state of knowledge can´t accept or dissaprove any one of them. As the most possible technology of mica deposition in the grave No. 11 of the Dubovany site, the first discussed variant seems to be the most realistic: thick (several mm) mica crystals were located on two places on the upper limbs of the shroud. In this case we suppose that individualisation of very thin mica sheets is the conse-

quence of various processes which should be unified under denomination „weathering processes".

MODE OF MUSCOVITE OCCURRENCES IN NATURE

Muscovite – $KAl_2(Si_3Al)_{10}(OH,F)_2$ – is the rock-forming mineral being one of the sheet silicates group. It forms very thin sheets of various size of transparent/translucent appearance.

Muscovite is the rock-forming mineral of several rock types.

a) It is constituent of leucocratic granite-clan rocks, which within the Western Carpathians mountain chain form backbone of individual mountain ranges, e. i. the Malé Karpaty Mts., the Považský Inovec Mts., the Tribeč Mts. and the others. Muscovites of this rock-clan are of 2–3 mm in diameter.
b) Muscovite is rock-forming mineral of various types of mica-schists. Last mentioned form metamorphic mantle of the granite-granodiorite massifs. Mica-schists are present in the most core mountain of the Western Carpathians, being of 1–4, rarely to 5–6 mm in diameter.
c) The third, from the point of view of elaborated problematic, muscovites in granite pegmatites are the most important. Granite pegmanites are corse-grained rocks, in which individual crystal reach in places several cm dimensions. Based on the fact that in the given grave muscovite platelets were of 1–8 cm^2 dimensions, in the following we concentrate our attention to pegmatites, as the source rocks, as well.

Due to its chemical stability, its smal platelets (mostly of 1–2 mm size) muscovites are constituent of the river beds (sands). Manyfold repeated change of temperature (summer vs. winter), as well as humidity of the upper horizons of the vertical profile, large muscovite aggregates have been splitted into individual very thin (thinner as 0,00 x mm) flakes sometime with yelowisch-lightbrown appearance. Such colorization is the effect of disseminated Fe oxids and hydroxids in spaces between individual muscovite sheets.

Muscovite, namely in the past, has been used as electroinsulating material and additive to the plasters for outside houses surface decoration.

In the close vicinity of the studied grave southern part of the Považský Inovec Mts. and the southern part of the crystalline core of the Malé Karpaty Mts., as well, are the most hopefull areas of muscovite of mentioned size occurrences. Namely in the Malé Karpaty Bratislava granite-granodi-

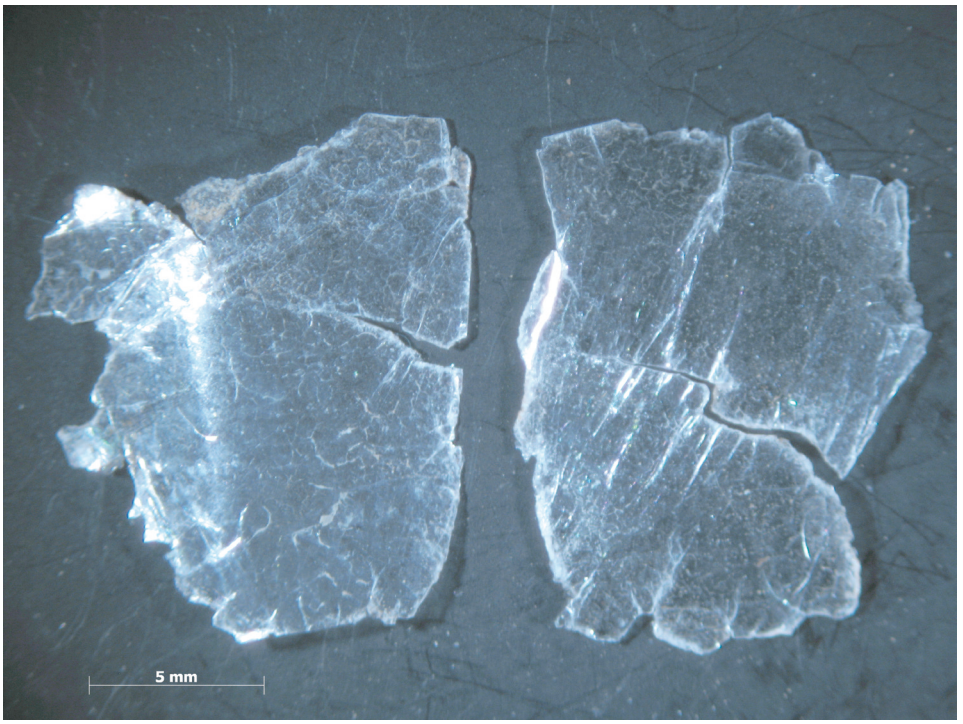

Fig. 4. Morphology of individual muscovite sheets. *Foto J. Mihályová and D.Staššíková-Štukovská.*
Ryc. 4. Morfologia pojedynczego płatka muskowitu. *Fot. J. Mihályová i D. Staššíková-Štukovská.*

orite body numerous granite pegmatite veins and irregular nests are known to occur. Their quantity is the highest among the other granite-clan massifs of the Western Carpathian Mts. Muscovite in the granite-clan rocks are of the size 2–4 mm in diameter, so these rocks we could exclude from the following considerations.

During the last decades muscovite granite pegmatite with minerals of the rare elements from the vicinity of village Moravany nad Váhom (Moravany upon Váh) has been studied (Uher and Broska 1989). This pegmatite body, being of lense shaped morphology is approximately 100–150 m in length and till 20 metres of thickness (l. c.). It is only partly cropping out on the ridge Striebornica, some 3 km to the ESE from the central part of the village Moravany nad Váhom. Within the time period 1936–1944 this granite pegmatite body was expoited for its muscovites being used as plaster additive.

The Moravany nad Váhom granite pegmatite body do occurs in the two-mica granodiorite to granite in places passing to the aplitoid granite varieties (Fig. 3). One side of the body under consideration is enplaced in paragneisses forming metamorpic mantle of the granite pegmatite body. Based on the detailed field survey Uher and Broska (1989) formulated conclusion that pegmatite body has zonal internal structure with aplitic rims and the quartz central zone. Mentioned authors in the granite pegmatite body under consideration described presence of accessory minerals garnet – gahnite – columbite-tantalite. Based on their presence they ranked discussed granite pegmatite body to the group of muscovite – rare earth elements granite pegmatites.

Formation of mineral association of discussed granite pegmatite was long forming process, during which 2 generations of muscovite has crystallized. First generation is represented by translucent large crystals of the given mineral, meanwhile the second generation is reprersented by small (1–2 mm) crystal of light green luster. Last one originated by hydrolysis of feldspars in concluding stage of the pegmatite body formation.

RESULTS OF THE X-RAY WHITE MICA DIFFRACTION STUDY – EXPERIMENTALS

As in the muscovite I from the pegmatite body under consideration 263 ppm Li was detected (Uher and Broska 1989) there exists possibility that white mica under consideration represens solid solution of Li and K white micas, we realised x-ray diffraction study. Obtained patterns are presented on Fig. 5. There are 2 difractograms: A = white mica from the studied grave located near Dubovany village (Fig. 5 A) and B = white mica from the granite pegmatite body occurring in the vicinity of village Moravany nad Váhom (Fig. 5 B). Description of this granite pegmatite body is presented in paper by Uher and Broska (1989).

EXPERIMENTALS

To obtain x-ray patterns we used powdered samples of white micas which have been treated in VVCE SOLIPHA (Faculty of Natural Sciences Comenius University in Bratislava) using device BRUKER D8 ADVANCE in the theta – 2 theta geometry; Cu – anticatode ($\lambda\alpha_1$ = 1,54060 Å), Ni Kβ

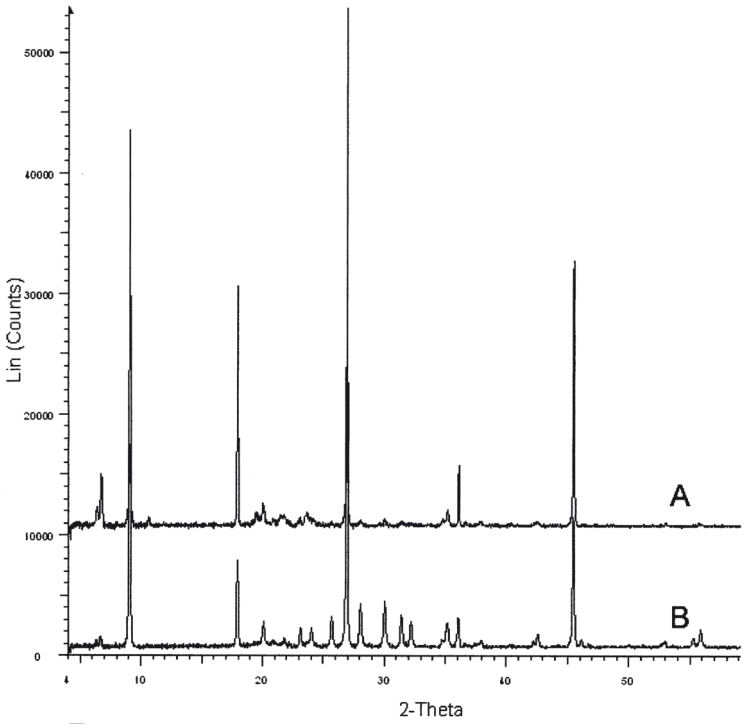

Fig. 5. X-ray diffraction patterns: A – muscovite from the grave; B – muscovite from the Moravany on the river Váh granite pegmatite body.
Ryc. 5. Wykres rentgenowsko-dyfrakcyjny: A – muskowit z grobu; B – muskowit ze złóż granitowo-pegamtytowych z miejscowości Moravany nad Váhom.

filters with detector LynxEye. Voltage = 40 kV and 40 mA. Individual steps in detection of intensities was 0.01° 2 Θ in 1 second, measured angles expressed on patterns = 4-60° 2Θ. Diffraction pattern was elaborated with the help of Diffrac^{plus} programme. Comparison of diffraction patterns to the ASTM file prove their identity with muscovite. (Fig. 5).

DISCUSSION

The main problems dealing with the discussed problematic should be summed up as follows:

- necessity of exact identification of white mica from the grave,
- based on known geological background of the wider area to try to find natural source of given white mica,

– to discuss the problematic of the mode and the original type of deposition of white mica occurrence in the grave.

As in geological bodies of various origin there do occur several white micas species as Cr-muscovite, Li-muscovite, astrolite and the others, we performed x-ray diffraction patterns to compare white mica found in the grave with that one occurring in just the granite pegmatite body known from the vicinity of village Moravany nad Váhom. Granite pegmatite body of this occurrence is known for its thick (up to 5 mm) white mica crystals.

It is generally known that thick (several milimetres) crystals of white mica in the processes of weathering split into the very thin sheets. Studied mica formed accumulations of such sheets disseminated irregularly in the form of nests on certain parts of the given human skeleton. Each of such accumulations represents set of individual sheets originated by disintegration of thick (several milimetres) crystals. Such morphology of white mica crystals is typical just for granite pegmatites, as well.

It ought to be mention that the place of pegmatite occurrence and the location of the studied grave are just on the oposite sides of river Váh. Their horizontal distance is approximately 18–19 km. This river, namely during the summer months, can be crossed walking as well as using rowing boat without difficulties. The topography bettween two mentioned points is flat, so no problems dealing with the mica delivery to the grave place shoud be expected.

CONCLUSION

Review of published sources concentrated on the graves from the 8/9th century didn´t brought evidences of the white mica crystals use as decorative/symbolic material in the graves of the Central Europe. Taking into account size of the white mica crystals (up to 3 x 3 cm leaves) found in the studied grave, we univocally rank them to be of granite pegmatite origin. It seems the most realistic to take into consideration generally accepted fact that mentioned pegmatite body is one of the largest granite pegmatite bodies in the Western Carpathians Mts. occurring ESE of the Moravany nad Váhom village (the southern delimitation of the Považský Inovec core mountain ridge), or unspecified granite pegmatite bodies within the Bratislava granite-granodiorite massif, being the backbone of the southern part of the Malé Karpaty Mts. ridge.

Realised roentgen diffraction studies (Fig. 5) present identity of both white mica sheet sets. Such comparison of diffractograms do not exclude possibility that white mica from the grave should be from the other granite pegmatite body. But on the other side mentioned granite pegmatite body occurring near the Moravany nad Váhom site, do occurs in one day walking distance from white mica discovery in the described grave (Fig. 1, 3), which strongly favor just this pegmatite body to be the source of white mica in the studied grave.

Mentioned conclusion documents the use of minerals in graves not only for decorative/symbolic purposes, as well as intentional mineralise separated form of this mineral pure in the Early Middle Age.

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REFERENCES

Balneologický spravodajca
2004 Balneologica Slovaca XXXVIII, 2001–2002, Piešťany, 165–175.

Budinský-Krička V.
1949 *Nález slovanského kostrového hrobu v Dubovanoch (okr. Piešťany)*, Časopis muzeálnej slovenskej spoločnosti 40, 22–24.

Staššíková-Štukovská D.
2004 *Polykultúrne archeologické nálezisko v Dubovanoch.*
2005 *Zur Herkunft der Nischengräber des Elite in der Kultur Großmährens. (Aus der Sicht der bisherigen Archäologischen Grabungsergebnisse in Borove und Dubovany*. [In:] P. Kouřil (Hrsg.) *Die frühmittelterliche Elite bei den Völkerndes östlichen Mitteleuropas*, Brno, Spisy Arch. Úst. AV ČR, Brno 25, 291–312.

Uher P., Broska I.
1989 *Muskovitický pegmatit s obsahom minerálov vzácnych prvkov pri Moravanoch nad Váhom (Považský Inovec*), Mineralia Slovaca 21, 163–173.

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Znalezisko jasnej miki w grobie (VIII–IX w. n.e.) w Dubovanach (zachodnia Słowacja): lokalizacja występowania jej złóż

Streszczenie

Cmentarzysko w Dubovanach, okr. Piešťany (ryc. 1) znajduje się na terenie wsi. Jak dotychczas przebadano 44 groby szkieletowe, z czego 10 typu niszowego i 3 pojedyncze groby koni zlokalizowane pomiędzy grobami ludzkimi. Do najbogatszych dotychczas przebadanych grobów mężczyzn na cmentarzysku należy niszowy grób nr 11, w którym pochowany był mężczyzna w wieku *senilis*. Grób ten nie był dotychczas publikowany poza niewielkimi wzmiankami, natomiast w niniejszym artykule zwracamy uwagę na znalezisko miki, która tworzyła w grobie niezwykłą część wyposażenia zmarłego.

Mika znajdowała się na paliczkach rąk. Na prawej ręce rozproszona ona była na owalnej przestrzeni o wymiarach 10x8 cm, a na lewej przestrzeń również owalna posiadała wymiary 5x20 cm. Listki miki występowały również w warstwie ok. 3 cm miąższości, gdzie były one przemieszane z ziemią (ryc. 2). Stwierdziliśmy je jako listki (ryc. 4) złożone z od jednej do trzech warstw zalegających na sobie, rozproszone intencjonalnie, bez wyraźniejszych zauważalnych śladów współczesnej ingerencji. Z czterech możliwych powodów wynikających z kontekstu znaleziska (które komentowaliśmy w tekście) za najprawdopodobniejsze uznajemy ułożenie listków jako dwóch grubych kryształów miki o powierzchni 5–6 cm^2, które znajdowały się w grobie na obydwu rękach. Te grube kryształy (zbiór listków) rozpadły się na pojedyncze listki różnej wielkości.

Praktycznie bezbarwne listki miki wskazują na muskowit, jednak aby wykluczyć możliwość, że chodzić tu może o ciemną mikę wybieloną w wilgotnym środowisku, listki miki z grobu i mikę pochodzącą z jej przypuszczalnego miejsca wydobywania poddaliśmy badaniom rentgenowsko-dyfrakcyjnym. Zaprezentowany wynik (ryc. 5) dokumentuje identyczność miki z grobu (ryc. 5 A) i przypuszczalnego miejsca jej pozyskiwania (ryc. 5 B), przy czym w obydwu przypadkach idzie o muskowit.

Za skałę macierzystą miki z grobu uważamy złoża granitu pegmatytowego występujące w miejscowości Moravany nad Váhom. Odległość w lini prostej pomiędzy opisywanym grobem a wymienionym obszarem pegmatytowym wynosi 16 km, przy czym przestrzeń miedzy nimi tworzy dolina Wagu (ryc. 1B; 3). Złoża były w poprzednich latach badane przez przez P. Uhera i I. Broska (1989). Według ich ustaleń złoża granitowego pegmatytu posiadają powierzchnię w kształcie soczewy długości 100–150 m, maksymalnej głębokości do 20 m, które jednym końcem przenikają z granitu do gnejsów (ryc. 3). Wyżej wymienieni autorzy zauważyli, że w pegmatycie z Moravian nad Váhom zawartość muskowitu sięga: Li = 263 ppm, co było jedną z przyczyn zrealizowania badań rentgenowsko-dyfrakcyjnych.

Dotychczasowy stopień rozpoznania problematyki pozwala nam stwierdzić, że jasna mika w grobie jest muskowitem. Na podstawie wielkości listków ustalono, że chodzi o kryształy muskowitu z granitowego pegmatytu występującego na granicy granitów i paragnejsów. Ten obszar pegmatytowy był w poprzednim stuleciu przedmiotem powierzchniowego wydobywania muskowitu (używanego jako domieszka do tynku).

Znalezisko muskowitu w grobie w Dubovanach z udowodnionym pochodzeniem z niedalekich Moravan nad Váhom poświadcza świadome pozyskiwanie w czystej postaci

tego minerału już we wczesnym średniowieczu. Jest to, jak dotychczas, pierwszy na Słowacji i Morawach przypadek odkrycia muskowitu w grobie niszowym, który został przebadany oraz interdyscyplinarnie potwierdzony.

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