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THE COMPARATIVE CHARACTERISTIC OF VISCOUS FOSSIL RESINS OF CARPATHIANS, TRANSCAUCASIA AND SAKHALIN

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On the complex of physical and chemical properties the fossil resins of Carpathians, Transcaucasia and Sakhalin are characterized. Amber-like resins are referred to the group of viscous fossil resins; they are diagnosed as rumanite. Rumanite is dated, mainly, for areas, which have undergone folding.

Key words: fossil resins, rumanite, physical and chemical properties, Carpathians, Transcaucasia, Sakhalin.

In researches of fossil resins many scientists at various times were engaged, but the majority of their works has been devoted either exclusively to amber (succinite) [1, 2, 6], or to comparison of properties and structure of local finds of fossil resins with similar parameters of the same succinite [5, 7, 8]. It can be explained mainly by the fact that data on finds of fossil resins outside an area of distribution of amber (so-called Baltic-Dnepr amber-bearing provinces [2] or subprovinces [7]) in most cases were sporadic and fragmentary. With accumulation of data of a similar sort interest to studying physical and chemical properties of fossil resins and estimations of an opportunity of their practical use increased also. The present work is devoted to the comparative characteristic of some fossil resins of Carpathians, Transcaucasia and Sakhalin – regions where on preliminary data the versions of resins possessing high enough utilitarian potential have been found, which makes them suitable for use as raw material for jewels.

In our disposal there were about 100 samples of fossil resins from various displays of Carpathians, Transcaucasia and Sakhalin, kindly transferred to us for researches by T.N. Sokolova, and also by I.D. Sukacheva and K.J. Eskov. Collected during long-term field works the samples have been subjected to detailed studying at Brest State University and Institute of Geochemistry and Geophysics NAS of Belarus. The results of the researches can be shown to the following.

The morphology of the studied samples is rather various and represents one of the major properties of fossil resins. There are formations with natural surfaces of secretions, their fragments of the various form and size, limited by surfaces of rough break. In the variety the form of grains has very wide range – oval, cylindrical, crescent, isometric, current, etc. Acute-angled samples in the sizes yield to oval and basically do not exceed 4,0–5,0 cm. Current forms are admitted primary as a result of allocation of terpentine by coniferous trees. Secondary forms are got as a result of grindings of pieces of resins at carrying them by water streams. It, obviously, causes the smooth forms of the grains sometimes meeting on all specified displays. According to calculation of 100 grains on

share current forms it is necessary 4,0 %; isometric – 18,0; crescent – 15,0; grains of drop forms make 3,0 %. However grains with the primary form make 7,0 %, with a surface of a break – 93,0 %. Thus it is necessary to note, that the percent concerning "young" having chopped off is insignificant – 29,0 %. By these data, the degree of destruction of resins during their carry can be certain as average. Variations of fine and average grains are extremely various.

The colour range of resins is not so various: from light orange up to red-brown and dark-brown. By the degree of the transparency depending on quantity, size and distribution of bubble air, it is possible to allocate translucent and opaque versions, and between them numerous transitions, sometimes even within the limits of one sample are marked. Shine glass, fat, wax and matte. It depends on the character of the surface of samples, which, as a rule, smooth, is well ground at some places. The majority of microcracks characterizes the part of samples. Colour of the line depends on a degree of oxidation and was defined for each sample. The line is basically dark yellow or yellow-brown.

The luminescence, i.e. influence of ultra-violet radiation on behaviour of resins, testifies that the dark blue luminescence is occasionally the characteristic for translucent differences. For opaque differences the luminescence either is not noted at all, or observed as dim white-matte. Resins were irradiated at a room temperature with quartz lamp PRK-4.

The break characterizes superficial split of samples. There are rough, step and splinter breaks. Distinctions in character of breaks on samples from different displays are not established. The surface of a break is characterized by various patterns – mesh, radially radiant, wavy, etc.

Hardness and fragility – the major physical characteristics allowing not only to define an accessory of studied samples to the type of fragile or viscous resins, but also to predict their utilitarian potential, for example, an opportunity of jeweller processing. On a Moose's scale hardness of the studied versions of resins 2,5–3,0, i.e. a little higher then the characteristics of succinite. Microhardness of samples is certain by means of device PMT-3 on the polished surface at loadings in 5, 50 and 100 g (table 1).

Table 1

Characteristics of microhardness of fossil resins

Region	Colour	Loading, g		
		5	50	100
Carpathians	Light orange	27,68	29,50	31,32
	Dark yellow	28,34	29,15	30,02
	Yellowy brown	28,68	30,00	31,67
	Light honey	27,63	29,45	31,07
Transcaucasia	Dark yellow	26,01	29,95	32,90
	Light yellow	29,22	29,34	29,63
	Red brown	28,13	29,79	33,98
	Dark yellow	28,44	29,94	30,19
Sakhalin	Red yellow	27,11	28,94	30,73
	Dark yellow	27,96	28,06	29,12
	Dark yellow	27,19	28,58	32,14
	Dark red	27,51	29,96	31,76

Limits of fluctuations of hardness are great enough (26,0–34,0 kg/mm^2), but average values of data for various grains fluctuate in narrower limits (27,5–32,5 kg/mm^2). And

hardness does not depend on a rating of fossil resins, as values for translucent and opaque grains are practically identical. Cracks of destruction appear at loadings hardly more than 200 g. Fragility, or the plasticity of the investigated substance influences the degree of its hardness. It is defined by that loading at which there is on the sample the first visible crack of break, and in the studied versions of resins fragility never falls below 200 g, sometimes reaching almost 300 g. On the average the number of fragility varies within the limits of 220–270 g, i.e. is unconditional, and corresponds to the characteristics of viscous resins.

Analysing obtained data it is possible to note their conformity to values, characteristic for viscous resins, so, the studied versions of resins should give in well to technical processing (to polishing, etc.) and approach for manufacturing from them art products and jeweller ornaments.

Density of fossil resins was defined by direct measurement of volume and weight. Practically for all investigated samples the density of 1,02–1,18 g/cm^3 is characteristic.

The chemical element structure of fossil resins is presented in table 2.

Table 2

Chemical element structure of fossil resins

Region	Colour	The maintenance, %				
		C	H	S	N+O	C/H
Carpathians	Light orange	77,84	9,66	1,60	10,90	8,06
	Dark yellow	80,98	10,46	0,95	7,61	7,74
	Yellowy brown	78,34	10,25	0,24	11,17	7,64
	Light honey	79,90	10,15	1,24	8,71	7,87
Transcaucasia	Dark yellow	77,77	10,01	–	12,22	7,77
	Light yellow	78,87	9,78	–	11,35	8,06
	Red brown	78,73	9,37	–	11,90	8,40
	Dark yellow	77,99	9,99	–	12,02	7,80
Sakhalin	Red yellow	79,81	10,35	0,07	9,77	7,71
	Dark yellow	80,29	9,82	–	9,89	8,17
	Dark yellow	79,59	10,25	0,09	10,07	7,76
	Dark red	80,09	9,13	–	10,78	8,77

Internal structure and inclusions – a subject of special researches in the near future. Now we shall note that a lot of fossil resins for studying under a raster electronic microscope of character of a surface, fresh having chopped off and definitions in samples of microcracks and bubble air are selected.

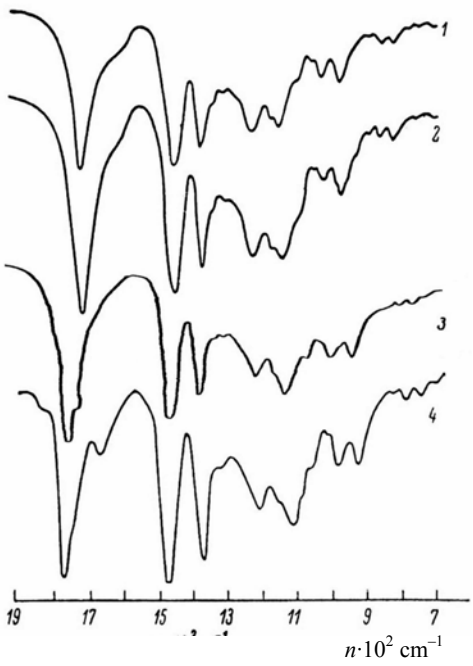
Thermal characteristics of fossil resins are important both for definition of their technical characteristics, and for studying structural features. For diagnostics of resins to this attribute such parameters, as temperature of a softening (T_s) and temperature of current (T_c), which with reference to polymeric connections of not crystal structure are more informative, than temperature of fusion are used. The temperature of a softening depends on nature polymer; the temperature of current reflects a degree of polymerisation. For the first time the method was used by S.S. Savkevich and T.N. Sokolova [4]. Supervision of behaviour of fossil resins in a temperature floor allows speaking about their high thermal stability inherent in viscous resins (table 3).

Table 3

Thermal characteristics of fossil resins

Region	Colour	T_s, °C	T_c, °C
Carpathians	Light honey	130–170	370
	Dark yellow	170–270	410
Transcaucasia	Light yellow	160–200	350
	Dark yellow	220–260	370
Sakhalin	Red yellow	120–180	360
	Dark red	180–250	420

The infrared spectrometry remains the most reliable diagnostic attribute allowing in a complex with other modern physical and chemical methods of researches to establish a specific accessory of fossil resins. Infrared spectra of the studied versions of resins of Carpathians, Transcaucasia and Sakhalin as a whole are similar to each other, are characterized by presence of the same strips of absorption and differ only by a parity of intensity of these strips (see figure). Application of the method confirms S.S. Savkevich's conclusions [3] concerning the distribution in these areas of such version of viscous pitches as rumanite.



Infrared spectra of typical samples of fossil resins:
1 – rumanite (Ploesti, Romania); *2* – rumanite (Delyatin, Ukraine); *3* – rumanite (Sakhalin, Russia); *4* – rumanite (Lachin, Azerbaijan), according to S.S. Savkevich [3] and the author.

The complex of the lead physical and chemical researches of fossil resins of Carpathians, Transcaucasia and Sakhalin allows to characterize possessing the certain variations of structure and properties of pitch of these regions and to make their comparative diag-

nostics. By the results of the researches samples of amber-like resins are carried to a group of viscous fossil resins and diagnosed as rumanite. Thus, not only the separate facts of finds within the limits of investigated regions of fossil resins suitable for practical use prove to be true, but also the dependence between finds of the certain kinds of resins and features of geological history of territory of their distribution is established. Rumanite, concerning to most strongly change owing to processes of catagenesis versions of fossil resins is dated basically for the areas tested during the development pleat formation, accompanied by increase in temperature and pressure. The big interest for the further researches in this direction represents that fact, that within the limits of both Carpathians, and Transcaucasia, and Sakhalin alongside with rumanite other versions of fossil resins not concerning to group of viscous resins and not suitable for use in the jeweller industry are met as well. Nevertheless, their studying should be continued for finding-out the reasons led to the formation on rather small areas of fossil resins so seriously differing on properties and their exact diagnostics, finally promoting the decision of a problem of genesis of these unique natural formations.

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ПОРІВНЯЛЬНА ХАРАКТЕРИСТИКА В'ЯЗКИХ ВИКОПНИХ СМОЛ ПЕРЕДКАРПАТТЯ, ЗАКАВКАЗЗЯ ТА САХАЛІНУ

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За комплексом фізичних та хімічних ознак схарактеризовано викопні смоли Передкарпаття, Закавказзя й Сахаліну. Бурштиноподібні смоли зачислено до групи в'язких смол і діагностовано як руменіт. Руменіт приурочений, головно, до районів, які зазнали складкоутворення.

Ключові слова: викопні смоли, руменіт, фізичні та хімічні властивості, Передкарпаття, Закавказзя, Сахалін.

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