

DATA ON THE PHOSPHORUS CONTENT AND ORGANIC REMAINS OF MANGANESE OXIDE ORES FROM URKUT

(Preliminary report)

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INTRODUCTION

The phosphorus content of the manganese oxide ores, beyond certain limites, is undesirable from certain practical point of view, e. g. from that of the producing of ferromanganese. From that point of view it is interesting to examine the phosphorus content and its possible regional changing in the manganese oxide ores of Urkut. Further, also the study of the organic matter may results data completing our knowledge on the age and circumstances of formation of these manganese oxide ores.

Here below these two problems will be briefly discussed, the complete explanation of the problems mentioned above will be given only after bringing to an end the examinations under way.

THE PROBLEM OF THE PHOSPHORUS CONTENT OF THE ORES

In connection with the phosphorus content the following questions may arise:

a) whether or not a connection can be established between the change of the phosphorus content and the ore content of the samples, whether the phosphorus content is accompanied with the ore or with the gangue?

b) whether or not a regularity can be established in the distribution of the phosphorus content?

c) what mineral is the phosphorus-bearing one?

The distribution and changing of the phosphorus content

The phosphorus content of the different samples taken from various places of the mine is shown in Table 1. Therein are also comprised the percentual amounts of the following components: SiO₂, Fe₂O₃, Al₂O₃, MnO₂ + MnO, CaO.

Table 1.

No. of the samples	Site of the sampling	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃ weight per cent	MnO ₂ + MnO	CaO	P ₂ O ₅
1	Shaft II,	22,22	7,28	29,85	25,84	1,92	0,39
1/a	"	13,44	3,30	9,72	56,37	2,28	0,26
2	"	24,33	2,12	15,45	41,46	2,33	0,57
3	"	15,20	2,11	9,06	58,84	2,61	0,07
3/a	"	13,67	3,24	20,13	45,84	2,61	0,91
4	"	57,82	7,48	11,56	9,39	1,54	0,55
5	"	11,13	4,13	20,90	49,70	1,91	0,45
6	"	10,22	6,69	16,43	50,28	2,98	1,08
7	"	19,77	5,20	6,86	45,56	3,63	0,10
8	"	13,24	1,94	8,25	58,38	1,90	0,62
9	"	19,10	1,07	14,94	40,16	1,64	0,45
10	"	3,65	1,38	5,96	75,51	2,02	0,45
11	"	10,09	4,47	26,11	41,15	2,73	0,94
12	Shaft III,	12,00	5,03	16,43	49,80	1,87	0,10
13	chute 4	6,13	4,69	17,43	59,54	1,19	0,18
14	"	43,87	24,51	14,82	3,56	1,30	0,03
15	"	6,81	4,67	19,42	47,43	1,32	0,08
16	"	7,49	14,54	25,56	35,55	1,33	0,04
17	"	65,19	9,60	9,50	5,93	1,33	0,02
18	Shaft III,	27,00	1,63	3,01	35,17	12,39	7,97
19	chute 2	7,99	5,19	9,60	57,82	2,69	0,35
20	Mt. Csárda	1,66	3,09	37,43	45,34	1,27	0,31
21	"	34,50	22,61	24,42	0,53	2,21	0,63
22	"	30,32	25,27	29,17	0,55	1,78	0,61
23	"	6,80	2,30	65,15	13,42	1,05	0,34
24	"	7,51	3,59	56,45	20,05	1,22	0,44
25	"	43,24	17,92	9,25	3,98	2,69	2,39
26	"	55,19	22,29	9,65	0,85	0,97	0,13
27	"	21,54	12,13	18,44	34,08	2,14	0,42
28	"	50,43	15,19	14,58	0,87	3,14	0,66
29	"	52,06	4,08	24,68	14,79	0,99	0,21
30	Hoisting slope	3,99	2,50	10,93	69,23	2,43	0,28

As the manganese oxide content of the samples can be dissolved with dilute hydrochloric acid + hydrogen hyperoxyde treatment, the soluble part of the ores have been dissolved in such a way and the phosphorus content of these solutions have been determined too. The results are given in Table 2.

Table 2.

No. of the samples	P ₂ O ₅ % in the samples	P ₂ O ₅ % in the dissolved part of the samples
2	0,57	0,57
3/a	0,91	0,91
11	0,94	0,84
12	0,10	0,10
13	0,18	0,15
14	0,029	0,02
15	0,08	0,02
16	0,046	0,03
17	0,02	0,005
18	7,97	7,26
19	0,35	0,22
21	0,63	0,52
22	0,61	0,17
23	0,34	0,18

From the results above-mentioned at first sight it could be concluded that significant part of the phosphorus content is associated with manganese oxide content of the samples. The phosphorus content, however, does not change proportionately with the manganese oxide content — as it can be stated from Table 1 —, further, there are clayey samples with no or minimal manganese oxide content, but with considerable phosphorus content and on the other hand, high grade ore samples with relatively minimal phosphorus content can also be found. Thus, the data of Table 2 show at the most only that dissolving the manganese oxide components (and the hydrous iron oxides too) of the samples by treating with hydrochloric acid + hydrogen hyperoxyde, the phosphorus-bearing mineral also dissolves in a considerable amount.

Considering Table 1 it can not be stated that the change of the amount of some components would be proportionate with the change of the phosphorus content.

Hence, the first question in connection with the phosphorus content may be answered: on the basis of the data of analyses can not be concluded that the phosphorus content would be associated with the ore components of the samples.

The data of the Table 1, however, show some regional relations and connections regarding the change of the phosphorus content, though it can not be yet stated that the phosphorus content is higher or lower rather in the samples containing more ore or in the clayey specimens due to some regularity.

Namely, comparing the average P₂O₅ content of the samples from different sampling places, the following picture is obtained shown in Table 3.

Table 3.

Sampling place	Number of samples	min.	P ₂ O ₅ % max.	av.
Shaft II,	13	0,07	1,08	0,52
Shaft III; chute 4	6	0,02	0,18	0,07
Mt. Csárda	9*	0,13	0,66	0,41

* Omitting the solely extremely high value of 2,39 per cent.

On the basis of the above data it seems that the average P₂O₅ content is the lowest in the samples from the area of shaft III, chute 4, whereas those of the samples from shaft II and Mt. Csárda (open-cut mining) are similar with slight deviation, but six -- seventhfold of the lowest average value.

The possibility of regional distinguishing of certain sampling places with lowest P₂O₅ content requires further investigations to establish whether or not the area, in the neighborhood of chute 4, shaft III, with extremely low P₂O₅ content but relatively high manganese content, could be delimited horizontally and vertically and what quantity of ore of lowest P₂O₅ content represents etc.

The phosphate mineral of the ores

The assumption that the phosphorus is present as calciumphosphate, is at hand without any special investigations, however, to support this supposition and to identify the mineral itself, would be more circumstantial without a lucky specimen investigated, since there is no unequivocal relation between the change of the P₂O₅ and the CaO content as the latter may be present not only as the component of the apatite, hence, its total amount and its change, respectively, is not necessarily proportionate with the change of the P₂O₅ content.

The P₂O₅ content determined in sample No. 18, is relatively very high: 7,97 per cent. Similarly the CaO content is high: 12,39 per cent, related to the CaO content of the other samples. The F content of sample No. 18 was also determined: 0,70 per cent. On the basis of the ideal composition of fluorapatite, 0,71 per cent F would correspond to 7,97 per cent P₂O₅ determined in the sample. Thus, the phosphorus is presumably present in the sample as fluorapatite. These values would mean that the apatite content of sample No. 18 is about 20 per cent. It seems to be worthwhile to establish by further sampling in the vicinity of the sampling place No. 18 whether this substance with relatively high apatite content forms a thicker or thinner layer or represents a larger or smaller mass etc.

A further question may be the problem of the distribution and the origin of the fluorapatite in the manganese oxides ores of Urkut. The observations and data obtained make the assumption probable that one

part, and perhaps the more considerable part of the phosphorus, is of organic origin and it is transformed secondary to calciumphosphate, apatite. The other part at the same time is possibly present as the apatite of former rocks. The secondary apatite formed by the action of organisms or partly also by inorganic processes is very finely distributed, perhaps microcrystalline, microscopically unobservable. The very fine distribution of the apatite, considered secondary, is possible supported also by that observation that on concentrating the ores, sometimes the phosphorus content of the concentrate increases related to those of the rough ores.

In the section made from sample No. 18 very small needlets could be detected which probably can be identified with the primary apatite needles. These needles, however, occur so scarcely in the section that they can not result the considerable apatite content of this sample, therefore, it is presumed the more considerable part of the apatite to be present in very fine distribution.

THE PROBLEM OF THE ORGANIC MATTER

The chemical examinations of the manganese oxide ores from Urkut showed that the presence of organic matter must be taken into account in several samples.

This statement could be proved both by microscopical and pollen-analytical investigations too. In thin sections of the sample No. 18 algae and hypha threads, further some indeterminable organic matter could be noted. In the preparates made by customary pollen-analytical method some pollen species could be well identified as those of *Cingulatisporites*, *Eucomiidites troedssonii*, *Striatopollis*, *Quercus*, *Castanea*, *Amaranthaceae* as well as a certain sporomorpha with well preserved contour lines, further also parenchyma and epidermis relicts were recognizable besides organic matter of unknown origin. The pollen-analytical investigation was carried out by Mr. P. *Simoncsics*.

It is to be remarked that if in the presence of organic matter the CO_2 content of the samples is determined by igniting the samples in air-current at about 1000°C and absorbing the evolving CO_2 by soda-lime absorptions tube, the result will be the sum of the carbonate CO_2 and the CO_2 corresponding to the C content of the organic remains and derived from the latter by oxydation during the heating in air-current. Thus, using the above-mentioned method for CO_2 determination, without considering whether or not besides carbonates also organic remains are present, the amount of the carbonates calculated on the basis of the CO_2 content determined, may be sometimes too highly estimated not corresponding to the actual state. Further not alone the

manganese oxides of higher valency but also the presence of organic matter make questionable the exactness of the FeO determination. Finally, the determination of the pollen species found in the ores can furnish data to complete our present knowledge on the age of the deposition of the single sedimentary layers.

Thus, the comprehensive chemical and pollen-analytical study — with special respect to the organic remains — of the manganese oxide ores from Urkut seems to be required. The investigations are in progress.