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- China -

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ON THE MINERAL AND GRANULOMETRIC COMPOSITION OF AEOLIAN SANDS FROM ORDOS, WESTERN ALASHAN, AND THE MIDDLE HUANG-HO VALLEY

- China -

/Follwing is the translation of an article by M. N. Petrov entitled in Vestnik Leningradskogo Universiteta, /Proceedings of the Leningrad University/ Series on Geology and Geography, Issue 1, No 6, Leningrad, 1961, pages 19-32/

A physico-geographic study of sands in Ordos, eastern Alashan, and the middle Huang-Ho /Yellow River/ valley was made in the summer of 1957 by a Chinese-Soviet party of the Middle Huang-Ho Joint Anti-Erosion Expedition, the Academy of Sciences, Chinese People's Republic /CPR/. Along with other material, we collected over 80 samples of aeolian sands and native rocks -- the source of these sands: Cretaceous and Jurassic sandstones, and ancient and recent alluvial sands of the Huang-Ho basin.

A half of these samples was analysed in the Petrographic Laboratory of Sedimentary Rocks at the All-Union Institute of Geologic Exploration Scientific Research (VNIIGRI) (Leningrad).

The region under study encompasses a portion of the Huang-Ho middle course and the adjacent desert areas of Ordos and Alashan (see map).

The Huang-Ho middle course forms a great arc, north of Ordos and the Loess Country. Along this bend, about 1500 km long, the aspect of the river valley and channel changes. In the stretch from Lanchou to the Chungwei oasis, the river makes its way through a moderately to low mountainous country west of the Loess Plateau. Its channel widens to form the Chungwei oasis, with the great Yinch'an oasis several tens of kilometers to the north. Located at the eastern turn of the river is the Het'ao oasis, the largest and richest in this vicinity; it extends with a few interruption as far as Paot'ou. There are no large oasis in the eastern meridional course of the river, where it is again hemmed in by mountains, and flows through gorges up to 200-300 m wide, often forming rapids.

Along the western part of its bend, the Huang-Ho comes twice in a close contact with the Alashan desert sands. Coming right to the river channel in the Chungwei area are sands of the southeast Alashan desert, known in Soviet literature as the Tengeri.

North of Yinch'an from Shihtshuishang to Sanshihkung (a distance of about 100 km), the Huang-Ho valley constitutes the east boundary of

the Alasah desert proper. Here, its sands are deposited locally directly in the river channel. The right bank of this stretch of the river constitutes the western boundary of Ordos.

The east margin of the Alashan desert presents an ancient alluvial plain occupied chiefly by aeolian barkhan sands. They rest on ancient (Quaternary) lacustrine-alluvial deposits out of which they have been formed.

On the right bank of its latitudinal course, as far as the Paot'ou meridian, the river valley touches the Kuzupchi sand massifs.

Ordos occupies the northwest of the Huang-Ho bend. This is the province of a major intra-platform subsidence — the Ordos synclease. [1] /See Note/

(/Note/ 1. The mineralogical analysis was given on the fraction 0.01-0.25, the specific weight of the bromophor liquid, 2.9.)

Geologically, Ordos is not a homogeneous province. It contains ancient platform areas of Cretaceous and Jurassic sandstones covered by aeolian-eluvial deposits, as well as younger formations: troughs filled up with Quaternary lacustrine-alluvial deposits covered by present day barkhan sands.

The samples of native rocks (Cretaceous and Jurassic sandstones) and ancient alluvial and aeolian sands were collected more or less uniformly throughout these areas. The sampling locations are indicated on Map. /Map and tables at end of article./

MINERALOGICAL CHARACTERISTICS OF NATIVE ORDOS ROCKS AND OF AEOLIAN SANDS FORMED OUT OF THEM

Data in Table 1 on the mineral composition of sandstones, ancient alluvial, and aeolian sands from various areas of Ordos lead to the following conclusions:

1) Predominant in the heavy fraction of red-brown Cretaceous sandstones from Ordos are such minerals as garnet (20; 24, and 45%) and zircon (4.5; 5.5, and 6.6%), with hornblende prominent in the heavy fraction of Cretaceous green-gray sandstones (63; 59, and 77%).

2) In the area of primary dispersion of the Ordos native rocks — gray-green to red-brown Cretaceous sandstones — the aeolian sands which have originated from them, too, are characterized by a corresponding predominance of either hornblendes or garnets, in their heavy fraction. For instance, drab-gray aeolian Ordos sands, related to the gray-green sandstones, carry a considerable amount of hornblende (34, 33, and 41%); such sands can be called hornblendic.

The drab-gray aeolian Ordos sands located in the outcrop area of red-brown sandstones are characterized by the prominence of garnet in their heavy fraction (33; 20; 35; 36, and 39%), along with a considerable amount of hornblende (24-34%). They may be called garnet sands.

3) In the southeast Ordos, an area of water-laid and aeolian accumulation of the weathering products of Cretaceous and Jurassic sandstones from the central and eastern Ordos, the mineral composition of ancient alluvial and aeolian sands is mixed garnet-hornblende

(hornblende, 30; 34; 42 and 44%; garnet, 17; 18; 22 and 26%).

4) Sands from the Hangyingch'ih area and the Kuzupchi sand massif are marked by the predominance of epidote (24; 27 and 36%) along with hornblende (20; 28%), in their heavy fraction. In the central Ordos sands, epidote, when present at all, occurs in very small amounts (0.5-1.5%). Such sands may be called epidotic.

5) With the exception of the Kuzupchi massif and the southeast Ordos, the aeolian Ordos sands are poorly sorted and rounded. This suggests their comparatively young age, which is also corroborated by field observations (Table 2).

SANDS FROM THE EAST BORDER OF THE ALASHAN DESERT

Sand samples from the east border of the Alashan desert were collected at a number of points, from the Payang-Huot'o area to Sanshenkung, as well as in the Tengeri desert (see map). The east desert boundary in that area exhibits considerable variations. It is fairly sharp at its contact with the foothill plain of the Huolanshan (Alashan) Range. Widely developed here are thick sands in barkhans up to 25 m high. They advance slowly but steadily toward the plain. The higher barkhans, however, stop about 35-40 km short of the mountains, where their progress is halted by vegetation which overgrows them, fed by artesian waters flowing west to the sands, across the foothill plain.

North of the Alashan Range, the Alashan desert boundary turns east, as far as the Huang-Ho valley. In the area between the settlement, Paitseti, and the town of Sanshenkung, the Alashan sands locally touch the river channel and enter it; north of Sanshenkung, they border on cultivated lands of the great Het'ao oasis.

In that region, we collected samples of proluvial sands from the Huolanshan foothill plain (sample No 8), ancient alluvial sands from the Davsannur (Ch'ilant'ai) Lake depression (sample No 13), and aeolian sands from the entire length of the above-described desert boundary (samples Nos 15, 9, 12, and 22).

The Tengeri desert sands occupy the southeast of the Alashan desert. Here, the eastern boundary of this desert varies with relation to the Huang-Ho valley. In the Chungwei area, the Tengeri sands come right to it. In the area of village Sap'ot'au, they are blown into the channel from the high and steep (over 100 m) original river bank. In the vicinity of Chungwei, where the Huang-Ho valley widens, the sands descend to it from the original bank, threatening to bury the oasis. North of Chungwei, the progress of the Alashan desert sands is barred by a low mountain range (about 500 m above the valley) which is a south terminal spur of the Huolanshan Range. In a number of places, such as village Shihhuopu, 70 km north of Chungwei, and in the area of village Huojapang, 30-38 km north of Chungwei, the sands break through this range and are filling up the Sang-ch'u canal, threatening the populated centers. These sands are marked by their fine grain.

The Tengeri sands are not homogeneous. Their east border, which we have studied, presents an area of broad development of barkhan sands.

They rest either on ancient alluvium or else on native rocks represented in the Sap'ot'ou area by red Permian sandstones. Active dispersion of ancient alluvium can be observed in a number of places (samples Nos 28, 29, and 30).

The presence of barkhan sands on outcropings has been brought about by their easterly and southeasterly advance.

The Mineral composition of sands on the east border of the Alashan and Tengeri deserts suggest their considerable difference from the Ordos sands.

Data on the mineral composition of sands from the eastern border of the Alashan desert and the eastern part of the Tengeri desert (Table 3) lead to the following conclusions:

1) There is no substantial difference in the amount of quartz and feldsars in the light fraction of all samples, except for the sand samples No 2 from the Tengeri desert and No 22, the Alashan desert, where the quartz content is less than half while that of siliceous fragments -- more than half. Feldspars are present in these samples in a very small amount (12%).

2) The east Alashan desert, including the Tengeri, is an area of high epidote sand (up to 45.5%) with a low hornblende content (not over 29%) and a very small amount of garnet (not over 4%). Ancient alluvial and aeolian Alashan sands should be called epidotic, this being their identifying feature.

3) The east Alashan margin ancient alluvial sands are well differentiated in their mineral composition. They differ from the Ordos sands by their better rounding. This points to a longer reworking of the sand material and to an older age of the Alashan sands as compared with the Ordos sands.

4) The similarity in mineral content for the Tengeri and east Alashan sands suggests their single source and a uniform formation process.

SANDS OF THE MIDDLE HUANG-HO VALLEY

Shifting sands occur in the middle Huang-Ho valley in isolated massifs and in bands. Their origin is different in different parts of the valley:

1) sands blown out of ancient alluvial and present day deposits of the Huang-Ho, within its I and II terraces;

2) sand brought in the Huang-Ho valley from the Alashan desert (along the meridional course) and from Ordos (along the latitudial stretch of the river bend).

The mineral composition of the sands varies depending on the origin of the sand bodies. A mineral analysis of the middle Huang-Ho valley sands (Table 3) shows a considerable similarity in the composition of sands from the right side of the valley where it touches the Alashan sands and the western margin of Ordos, with both the Alashan sands (in their high epidote content) and the Ordos sands (high hornblende content).

Sands on the left side of the middle Huang-Ho valley, between

Chungwei and Paot'ou, can be assigned to the Alashan mineral type.

For example, epidote (37%) and hornblende (35%) predominate in gray alluvial Huang-Ho sands near Yinch'an. The same is true for the aeolian sands. The right bank Huang-Ho sands, at their contact with the west Ordos boundary, are very similar to the Ordos sands.

It is of interest that the lower Huang-Ho sands retain the features of all three sand types of its middle course --- the hornblende, and the garnet, typical of Ordos, and the epidote, typical of the Alashan desert (samples Nos 80 and 81).

SUMMARY

Several mineral regions can be identified within the area under study, comprising parts of Central China (Ordos, eastern border of the Alashan desert, and the middle Huang-Ho valley): the ancient alluvial Alashan, eluvial-deluvial Ordos, ancient lacustrine-alluvial Ordos, ancient alluvial Huang-Ho, and present day alluvial Huang-Ho. Their sands differ considerably in their mineral composition.

The Alashan province, which probably occupies all of the east of this sand body, is characterized by the prominence of epidote in its heavy fraction, with a small amount of hornblendes.

The Ordos eluvial-deluvial province embraces most of Ordos. It is marked by the predominance of eluvial-deluvial processes which put a definite stamp on the aeolian sands (similarity between the mineral composition of Cretaceous sands and the aeolian sands formed out of them; a low aeolian differentiation of sand material; the poor rounding of sand grains; etc).

Aeolian sand in this part of Ordos can be divided into three types; drab-yellow hornblendic, formed in the weathering of gray-green sandstones; brownish-yellow originated from red-grown sandstones; and grayish-yellow garnet-hornblendic blown out of deluvial and lacustrine sands.

The ancient-alluvial Ordos province takes up the southeast of Ordos, north of Yulin. In the Quaternary, it probably was a lacustrine basin gathering waters and weathering products from the Ordos areas to the north. For that reason, its sands have a more complex hornblende-garnet composition: they combined the features of all three types from the eluvial-deluvial and lacustrine Ordos province sands.

The Ordos-Kuzupchi sand massif has a place of his own. Mineralogically, its sands are similar to those of the Alashan. This part of Ordos is genetically related to the activity of an ancient Huang-Ho whose basin probably had a different configuration during a rainy period of the Quaternary. More specifically, it appears that the main channel of this ancient Huang-Ho ran over a vast ancient alluvial plain of the Alashan desert. Its present day traces are found in the issueless streams and dry channels in the Alashan plain and a broad distribution over it of ancient alluvial and lacustrine deposits. It is possible that the Kuzupchi sand massif itself is an ancient Huang-Ho terrace. [2]

[2] Note 2: In 1958-1959, we succeeded in gathering several score

of additional aeolian sand samples in the Alashan desert: in the Patang-Chareng sand massif; on the east border of the Mingchin oasis; and in the central Alashan. All these sands are well worked over by wind and well sorted, with the fine fraction predominant. Their heavy fraction, too, carries much epidote. This corroborates our assumption of the details in mineral composition for the Alashan aeolian sands.)

The Huang-Ho region is of a mixed nature. Reflected in the mineral composition of sands from the ancient and the present Huang-Ho valley are specific features of all of the above-named provinces. Here, all three principal minerals of the heavy fraction -- hornblende, epidote, and granet -- are of almost the same importance, while they are strictly localized in Ordos and Alashan.

The mineral composition of the light fraction, unlike that of the heavy fraction, does not exhibit appreciable differences. However, the quartz and feldspar content in the Ordos aeolian sands is somewhat higher than in the Alashan. On the other hand, the Alashan, Tengeri, and Kuzupchi sands have a higher content of siliceous rock fragments and weathered minerals. This can be explained by an older age of the aeolian sands from these areas and a longer process of the wind action on them.

Thus our comparative mineral analysis of sands from Ordos, Alashan, and the middle Huang-Ho valley clearly emphasizes the difference in their origin.

The effect of physical weathering and the wind and water transportation on the mineral and mechanical composition of sands under the Central Asian desert conditions varies as to its form and degree.

A change in the mineral composition of sand originated in a wind erosion of source rocks is reflected in minerals of both the light and heavy fractions. Specifically, the content of readily disintegrating minerals, such as hornblende, pyroxenes, feldspars, and epidote, decreases in wind transportation of ancient alluvial sands. Conversely, the amount of more abrasion-resistant minerals -- quartz, garnet, etc -- increases (samples Nos 12 and 13; 27 and 28; 72 and 73).

The Alashan aeolian sands are more uniform in their mechanical composition than the ancient alluvial sands of their origin. Their bulk, at times as high as 95%, consists of a fine sand fraction (0.25-0.10 mm). The amount of coarser grains is insignificant; dust-like particles, however, are present in the amount of 3-4%.

Most of the sand grains are well-rounded, thus suggesting a long wind action on the Alashan desert sands, i.e., their fairly old age.

The mechanical composition of aeolian sands from Central Ordos, as compared with that of their Cretaceous source sandstones, suggests but a slight mixing in blowing.

The main body of aeolian sands consists here of fine (up to 58%) to medium (up to 62%) fraction. This suggests a younger age for aeolian sands from this part of Ordos, which is also corroborated by field observations.

The mechanical composition of aeolian sands from the Huang-Ho valley is more uniform. These are fine-grained sands with up to 90% of the 0.10-0.25 mm fraction. It is to be noted that ancient alluvial

sands of the Huang-Ho valley, too, are fairly well sorted and carry up to 87% of the fine fraction.

This is readily explained by the fact that a considerable amount of blown sands has long been coming to the Huang-Ho valley from the Alashan desert in the west.

The above-described processes of considerable and well-expressed change in the mineral and mechanical composition of wind blown sands are almost identical with those operative under Central Asian /Turkestan/ desert conditions /2/, thus suggesting similar regularities and trends of aeolian differentiation in both provinces.

BIBLIOGRAPHY

1 Sinitsyn, V. M., Ordos i Alashan /Ordos and Alashan/, Publishing House of the USSR Academy Science, 1954.

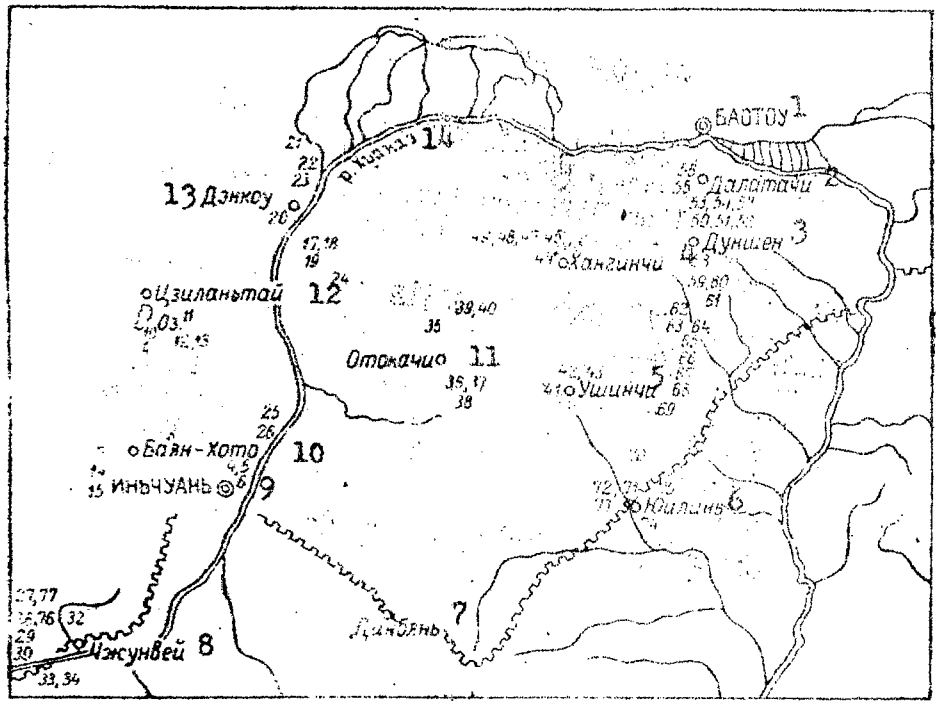
2 Sidorenko, A. V., "Aeolian Differentiation of Matter in Desert," Izvestiya AN SSSR, /Proceedings of the Academy of Science of the USSR/, Series on Geology, No 3, 1956.

3 Baturin, V. P., Petrograficheskiy Analiz geograficheskogo proshlogo zemli po terrigennym komponentam /Petrographic Analysis of Geographic Past of the Earth From Terrigenous Components/, Moscow-Leningrad, Publishing House of the Academy of Science, USSR, 1947.

4 M. P. Petrov, "Granulometric and Mineral Composition of Aeolian Sands From Ordos, eastern Alashan, and the Middle Huang-Ho Valley," Acta Geographica Sinica, Vol 25, No 1, 1959 (in Chinese).

5 Rukhin, L. T., Granulometricheskiy Metod Izucheniya Peskov, /Granulometric Method of the Sand Study/ Publishing House of Leningrad State University, 1947.

SAMPLING LOCALITIES



Legend:

1. Paot'ou
2. Dalatachi
3. Tungshen
4. Hangyingch'ih
5. Wushinch'ih
6. Yuling
7. Tingpien
8. Chungwei
9. Yinch'an
10. Payang-Huot'o
11. Out'ok'ach'ih
12. Ch'ilangt'ai
13. Tengk'ou
14. Huang-Ho River

Sampling localities

No 2 Crest of a barkhan chain. Terrace II on the Huang-Ho, 10 km west of Chungwei. Tengeri sands.

3 Crest of a high barkhan chain on the high original bank of the Huang-Ho. 23 km west of Chungwei. Tengeri sands.

5 Ancient alluvial sands of the Huang-Ho valley, the source of aeolian sands (sample No 4), 40 km west of Yinch'an.

8 Sand from the top of a wind-blown knob. Overgrown sands in the Huolanshan foothill plain, 18 km east of Payang-Huot'o. Proluvial sands.

9 Crest of a barkhan chain. Isolated barkhan chains in the depression of salt lake Ch'ilangt'ai, 85 km north of Payang-Huot'o. Eastern border of the Alashan desert.

12 Crest of a high barkhan chain. Post Chilinoi, 13 km southwest of Ch'ilangt'ai Lake. Large barkhan forming sands. Eastern margin of the Alashan desert.

13 Lacustrine alluvial deposits in the Ch'ilangt'ai Lake depression, the source of aeolian sands (sample No 12). Eastern margin of the Alashan.

15 Crest of a high barkhan chain. Eastern margin of the Alashan, 20 km southwest of Payang-Huot'o.

16 Crest of a barkhan chain. Isolated barkhan chains 25 km south of Yinch'an. The II Huang-Ho terrace.

17 Crest of a small barkhan chain. A small massif of shifting sands 35 km south of Tengkou, right bank of Huang-Ho. The II sand-gravel terrace, the source of these sands.

19 Crest of a barkhan chain. A massif of shifting sands on the II Huang-Ho terrace (right bank), 5 km north of village Pangyuanti.

22 Crest of a high barkhan chain, 15 km south of Sanshengkuang. Eastern border of the Alashan.

24 Red Jurassic sandstone. High plain on right bank of the Huang-Ho, 70 km south of Sanshengkuang.

25 Crest of a barkhan chain advanced as far as the village Shihhuopu oasis, 70 km north of Chungwei. These sands came from the Alashan desert, across low mountains; some of them were partly blown out of sand-gravel deposits in the foothill plain.

27 Crest of a barkhan chain at the Ipangts'uan Post, 60 km east of Chungwei. The Tengeri desert (sample fairly similar to No 1).

28 Alluvium (sandy loam) over sands in an ancient valley (now sanded up) on the east margin of the Tengeri, 52 km west of Chungwei.

29 Alluvial sand underlying the loam No 28, same locality.

30 Crest of a barkhan chain alongside a remnant of alluvial deposits (Nos 28 and 29) in an ancient valley on the east Tengeri margin,

52 km west of Chungwei.

33 Barkhan sands from a shifting sand massif on the right bank of Huang-Ho, opposite Sap'ot'ou. Sand drift.

36 Green-gray Cretaceous sandstone outcropping in the Lake Haolaitunor depression, 25 km southeast of Otok, Central Ordos.

37 Crest of a barkhan chain on the margin of the Halaitunor Lake depression, 25 km southeast of Otok, Central Ordos.

39 Red Cretaceous sandstone on the shore of the Lake Wulats'aiched depression, 17 km northeast of village Tsagan'nor, Central Ordos.

40 Crest of an isolated barkhan chain in the Wulats'aiched Lake depression, 17 km northeast of village Tsagan'nor, in a plain supporting a saline-meadow vegetation. This barkhan has been formed from blown out lacustrine deposits. Central Ordos.

42 Crest of a barkhan chain, 5 km northwest of Wushiin. A depression margin withmeadow vegetation. Eastern Ordos.

45 Crest of an isolated barkhan chain in the Huang-Ho valley, 12 km northwest of Hangin. Northern Ordos.

48 Gray-Green Cretaceous sandstone; same locality.

49 Crest of an isolated barkhan in a depression with meadow vegetation, 53 km east of Hangchin, Central Ordos.

53 Crest of a high barkhan chain on the high bank of river Hangt'aich'uang, 25 km south of Dalat. East margin of the Kuzupchi desert, Central Ordos.

54 Sandstone from the upper interval of Jurassic rocks in the area of sample No 53. Right bank of the Hangt'aich'uang.

55 Crest of a barkhan chain. Northeast margin of the Kuzupchi desert, along its boundary with the Huang-Ho valley at its junction with the Hangt'aich'uang valley. The northern Ordos boundary.

56 Crest of a barkhan chain. A small massif of intra-oasis sandstones in the Huang-Ho valley, 1 km east of Dalat. The II Huang-Ho terrace.

61 Outcroppings of red Jurassic sandstone in a ravine 25 km south of Tungsheng; an erosional hilly area.

63 Crest of a barkhan chain, 25 m high, 20 km west of Djasag, Eastern Ordos.

64 Crest of a poorly outlined barkhan chain 10 km east of Djasag, Eastern Ordos.

67 Crest of barkhan chain, 12 m high, 1 km south of village Shihpat'ai, 41 km south of Djagas, Eastern Ordos.

69 Crest of a barkhan chain, up to 15 m high, by the Wautykhai Lake, 77 km south of Djagas, Southeastern Ordos.

70 Red sandstone on the Yussuhe bank, 35 km north of Yulin, South Ordos.

72 Crest of a barkhan chain near village Niudzoliang, 12 km north of Yulin, South Ordos.

73 Alluvial sand from an interbarkhan trough in the vicinity of village Niudzoliang, 12 km north Yulin (same as No 72).

74 Crest of a barkhan chain blown on a loess hill slope, 7.5 km

southeast of Yulin, near the (Ch'ihnienhsia) Temple.

80 Semi-overgrown sands in the vicinity of Minjchuan, west of K'aifeng, the Huang-Ho valley-delta, Honan Province, an area of shifting sands.

81 Semi-overgrown sands, 10 km north of Cheng-chou, the Huang-Ho valley-delta, Honan Province, an area of shifting sands.

Table 1

MINERAL COMPOSITION OF CRETACEOUS AND JURASSIC SANDSTONES FROM ORDOS AND AEOLIAN SANDS FORMED OUT OF THEM

Fraction Composition	Cretaceous and Jurassic Sandstones, Ordos								Aeolian Sands, Dzhasag-	
	24*	35—a	36	39	48	61	70	54	42	63
Light Fraction										
Quartz	40	56	62	62	61	59	62	44	52	70
Feldspars	10	35	26	32	30	31	35	50	29	23
Analcite	32	—	—	—	—	6	—	—	—	—
Muscovite	—	—	Ca.[1]	Ca.	—	1	—	1,5	Ca.	—
Green Mica	—	—	Ca.	—	—	1	—	—	—	—
Chlorite	—	—	—	—	—	—	—	1,5	—	—
Weathered minerals	—	—	—	—	—		—	—	11**	—
Siliceous fragments	18	9	12	6	9	4	3	3	8	7
Heavy Fraction										
Ore minerals	66,0	12,5	8,0	34,5	21,0	43,0	72,0	65,0	20,0	38,0
Garnets	24,0	15,0	8,0	12,0	4,0	45,0	20,0	30,0	35,5	36,0
Hornblende	0,7	69,0	77,0	40,0	63,0	Ca.	0,5	Ca.	41,0	25,0
Epidote	0,7	—	1,0	2,0	8,0	6,0	0,5	4,0	0,5	2,5
Zircon	6,8	3,5	5,0	9,0	2,0	4,5	5,5	1,0	1,0	1,0
Rutile	0,3	—	—	1,0	—	0,5	1,5	—	—	Ca.
Sphene	1,5	—	—	1,5	0,5	—	—	—	0,5	—
Tourmaline	—	—	Ca.	Ca.	—	1,0	Ca.	—	0,5	Ca.
Pyroxenes	—	—	1,0	—	1,5	—	Ca.	—	Ca.	—
Staurolite	—	—	—	—	—	—	—	—	1,0	0,5
Andalusite	—	—	—	—	—	—	—	—	—	—
Disthene	—	—	—	—	—	—	—	—	—	—
Sillimanite	—	—	—	—	—	—	—	—	—	—

* Jurassic sandstone; other samples are Cretaceous sandstones. ** Alluvial sand.

(V. A. Atanas'yan and Ye. N. Ivanova, Analysts.) [Legend: 1 = Trace]

Table 1 (Con't.)

MINERAL COMPOSITION OF CRETACEOUS AND JURASSIC SANDSTONES FROM ORDOS AND AEOLIAN SANDS FORMED OUT OF THEM

Fraction Composition	Aeolian Sands											
	Dzhasag-Wushinch'in			Out'ok'a-ch'ih		Hangying-ch'ih		Kuzup-chi	Yuling			
	64	65	67	37	40	45	49	53	69	72	73**	74
Light Fraction												
Quartz	64	71	60	63	67	50	60	62	56	63	57	55
Feldspars	27	25	32	30	28	38	33	8	30	17	33	25
Analcite	—	—	—	—	—	—	—	—	—	—	—	—
Muscovite	—	—	Ca.	—	Ca.	—	—	—	—	—	5	—
Green Mica	—	—	—	—	—	—	—	—	—	—	—	—
Chlorite	—	—	—	—	Ca.	—	—	—	—	—	Ca.	—
Weathered Minerals	—	—	—	—	—	5	—	—	4	12	—	—
Silaceous fragments	9	4	8	7	5	7	7	30	10	8	5	20
Heavy Fraction												
Ore minerals	22,0	35,0	30,0	24,0	23,0	26,0	34,5	26,5	25,0	26,0	22,0	35,0
Garnets	67,5	20,0	35,0	33,0	39,0	10,0	8,5	12,0	18,0	26,0	22,0	17,0
Hornblende	6,0	33,0	31,0	24,0	34,0	28,0	22,0	20,0	42,0	34,0	44,0	30,5
Epidote	2,0	6,0	0,5	14,0	1,5	24,0	27,0	36,0	6,0	11,0	7,0	11,0
Zircon	1,0	4,0	3,0	2,0	2,0	3,5	5,5	2,0	3,0	1,0	3,0	5,5
Rutile	—	1,0	0,5	0,5	Ca.	—	0,5	—	0,5	0,5	0,5	Ca.
Sphene	—	1,0	—	Ca.	0,5	2,5	1,0	—	2,0	0,5	1,0	1,0
Tourmaline	—	Ca.	Ca.	Ca.	—	1,0	0,5	Ca.	1,0	Ca.	0,5	Ca.
Pyroxenes	—	—	Ca.	2,0	—	3,0	0,5	3,5	2,0	1,0	—	—
Staurolite	1,5		Ca.	0,5	Ca.	1,0	Ca.	Ca.	0,5	Ca.	—	—
Andalusite	—	Ca.	—	—	—	0,5	—	—	—	—	—	—
Disthene	—	Ca.	—	—	—	—	Ca.	—	—	Ca.	—	—
Sillimanite	—	—	—	Ca.	—	0,5	—	—	—	—	—	—

**Alluvial sand

Table 2

GRANULOMETRIC COMPOSITION OF SANDS FROM ORDOS, EASTERN ALASHAN, AND THE HUANG-HO VALLEY

Sample Nos.	Fractions						% of soluble fraction	% of heavy fraction
	>1.0	1-0.5	0.5-0.25	0.25-0.10	0.10-0.01	< 0.01		
Cretaceous and Jurassic deposits of Ordos								
35a	—	—	Ca.[1]	50,7	14,9	34,4	4,4	10,72
48	—	—	2,0	57,0	4,0	37,0	45,4	8,22
36	—	—	12,8	71,8	4,3	11,1	Ca.	1,47
70	—	—	6,9	40,9	23,6	28,6	6,0	0,40
39	—	—	2,7	66,6	9,3	21,4	2,4	0,67
24	—	—	5,2	60,4	7,2	27,2	3,2	0,72
61	—	—	0,6	62,3	14,1	23,0	8,6	2,09
54	23,0	29,4	16,3	18,0	5,5	7,8	30,6	7,06
Aeolian Sand of Ordos								
37	15,3	27,0	25,3	24,3	2,7	5,4	Trace Ca.	6,95
40	—	—	51,6	40,0	3,2	5,2	2,0	8,29
42	—	—	62,3	34,0	0,8	2,9	-	1,50
63	—	—	38,2	57,1	0,7	4,0	Ca.	1,09
64	—	29,7	40,8	24,7	0,5	4,3	—	2,91
65	—	1,5	15,5	70,8	5,0	7,2	—	4,55
67	—	—	6,3	89,0	1,0	3,7	—	2,62
45	—	—	38,7	43 3	11,6	6,4	2,6	4,46
49	—	2,5	25,9	58,0	8,0	5,6	Ca.	4,22
53	—	—	—	91,2	3,1	5,7	3,2	2,92
55	—	—	—	87,8	5,5	6,7	4,0	3,43
72	—	—	18,0	76,4	1,5	4,1	—	0,78
69	—	—	1,9	89,5	4,3	4,3	—	3,22
74	—	—	—	88,8	6,6	4,6	2,0	5,06
Ancient Alluvial Sand of Southeastern Ordos								
73	—	—	4.5	78,0	7,0	10,5	Ca.	1,50
Proluvial Sands of the Western Footmidl Valley of The Huolanshan Range								
8	Trace Ca.	9,2	14,0	55,1	13,9	7,8	2,0	2,47
Ancient Alluvial-lacustrine Sands of the Eastern Alashan								
13	—	—	—	91,4	3,3	5,3	2,8	3,24

[Legend: 1 = trace.]

Table 2 (Con't.)

GRANULOMETRIC COMPOSITION OF SANDS FROM ORDOS, EASTERN ALASHAN, AND THE HUANG-HO VALLEY

Sample Nos.	Fractions						% of soluble frac.	% of heavy frac.
	1.0	1-0.5	0.5-0.25	0.25-0.10	0.10-0.01	0.01		
Aeolian Sands of the Eastern Alashan								
15	—	—	8,7	81,1	4,8	5,4	2,4	1,96
9	Сл.	3,3	9,3	61,5	3,4	22,5	11,4	2,57
12	—	—	Сл.	95,5	1,6	2,9	—	2,90
Aeolian Sands of the Tengeri Desert								
3	—	—	—	95,2	1,0	3,8	Сл.	2,42
27	—	—	0,7	94,0	1,2	4,1	Сл.	1,74
30	—	Сл.	10,0	82,3	0,8	6,9	Сл.	1,62
25	—	—	—	85,0	4,2	10,8	Сл.	6,10
Ancient Alluvial Sands of the Tengeri Desert								
28	—	—	1,4	37,3	22,8	38,5	7,6	1,60
29	—	—	5,3	89,0	1,8	3,9	Сл.	1,72
Ancient Alluvial Sands of the Huang-Ho Valley								
5	—	—	—	87,2	8,9	3,9	3,4	2,62
Aeloian Sands of the Huang-Ho Valley								
16	—	1,3	9,6	74,1	2,3	12,7	4,2	2,80
22	—	—	—	85,6	3,4	11,0	4,6	2,37
56	—	—	9,9	73,4	7,1	9,6	5,6	2,43
2	—	—	—	92,7	1,5	5,8	Сл.	4,17
33	—	—	—	87,2	6,6	6,2	1,6	3,84
17	—	—	—	88,7	2,5	8,8	2,2	4,15
19	—	—	—	89,8	2,0	8,2	2,4	1,42
Aeolian Sands of the Lower Huang-Ho Course								
80	—	—	—	78,3	9,6	12,1	6,6	4,22
81	—	Сл.	41,5	55,2	1,4	1,9	Сл.	3,72

Note: The solubility % was determined in the cold, with 5% HCl, by N. V. Platonova.

Table 3

MINERAL COMPOSITION OF AEOLIAN SANDS FROM THE TENGERI AND ALASHAN DESERTS, AND THE HUANG-HO VALLEY

Minerals	Tengeri							Alashan	
	2	3	27	28	29	30	33	8	15
Light Fraction									
Quartz	40	52	70	65	54	65	63	64	60
Feldspars	12	24	14	21	24	20	21	25	32
Analcite	—[1]	—	—	—	—	—	—	—	—
Muscovite	Cn.	—	—	1	—	—	—	—	—
Green Mica	—	—	—	—	—	—	—	—	—
Chlorite	—	—	—	—	—	—	—	—	—
Weathered minerals	—	10	—	7	2	8	9	—	—
Siliceous fragments	50	14	16	6	20	7	7	11	8
Heavy fraction									
Ore minerals	33,0	20,0	29,0	24,0	30,0	39,0	33,0	23,0	20,5
Garnet	2,5	1,5	2,5	5,5	4,0	2,0	3,0	4,5	4,0
Hornblende	26,0	19,0	14,0	17,0	17,0	17,0	17,5	25,0	28,0
Epidote	36,0	56,5	42,5	51,0	44,0	40,0	41,5	42,0	45,0
Zircon	1,4	1,0	3,0	2,5	3,5	2,0	3,0	2,5	1,0
Rutile	0,5	Cn.	0,5	—	Cn.	—	Cn.	0,5	Cn.
Sphene	Cn.	Cn.	1,0	Cn.	Cn.	Cn.	Cn.	Cn.	—
Tourmaline	Cn.	Cn.	1,0	Cn.	0,5	—	0,5	0,5	—
Pyroxenes	1,0	2,5	2,5	—	1,0	Cn.	1,5	2,0	1,0
Staurolite	—	—	—	—	—	—	—	—	—
Andalusite	—	—	—	—	—	—	—	—	—
Disthene	—	—	—	—	—	—	—	—	—
Weathered minerals (epidote)	—	—	4,0	—	—	—	—	—	—

*Alluvial sands. V. A. Atanas'yan and Ye. N. Ivanova, Analysts.

[Legend: 1 = Trace.]

Table 3 (Con't.)

MINERAL COMPOSITION OF AEOLIAN SANDS FROM THE TENGERI AND ALASHAN DESERTS, AND THE HUANG-HO VALLEY

Minerals	Alashan		Alashan-Chilangt'ai			The Huang-Ho Valley						Huang-Ho Delta	
						Yinch'an		Talat		Tenkou			
	22	25	9	12	13*	5	16	55	56	17	19	80	81
Light Fraction													
Quartz	33	54	45	55	66	67	60	61	63	40	43	66	48
Feldspars	12	26	35	20	25	15	20	29	25	10	8,5	28	39
Analcite	—	—	—	—	—	—	—	—	—	—	—	—	—
Muscovite	Cn.[1]	—	—	—	—	Cn.	—	Cn.	Cn.	—	—	Cn.	—
Green Mica	—	—	—	—	—	—	—	—	—	—	—	—	—
Chlorite	—	—	—	—	—	Cn.	—	Cn.	—	—	—	—	—
Weathered minerals	—	—	6	—	—	—	7	—	3	13	—	—	—
Siliceous fragments	55	20	14	25	9	18	13	10	9	37	48.5	6	13
Heavy Fraction													
Ore minerals	37,0	35,5	27,0	25,0	26,0	21,0	25,0	29,0	29,0	40,0	30,5	31,0	28,5
Garnet	5,3	3,5	7,0	4,5	3,0	3,0	6,0	7,0	8,5	4,0	3,5	14,0	18,5
Hornblende	37,4	22,0	29,0	23,0	25,0	35,0	20,0	27,0	23,0	40,0	35,5	27,0	37,0
Epidote	15,8	32,5	30,5	31,0	36,0	37,0	41,0	31,0	33,0	9,0	27,5	23,0	7,0
Zircon	1,0	3,0	2,0	4,0	5,5	1,0	3,5	4,0	3,5	2,0	1,2	3,0	7,0
Rutile	0,3	Cn.	0,5	Cn.	—	Cn.	Cn.	1,0	—	0,6	Cn.	Cn.	0,5
Sphene	—	Cn.	0,5	0,5	Cn.	1,0	Cn.	Cn.	0,5	0,8	Cn.	0,5	Cn.
Tourmaline	—	0,5	0,5	0,5	Cn.	Cn.	Cn.	Cn.	0,5	—	0,7	0,5	0,5
Pyroxenes	3,2	3,0	3,0	4,0	4,5	2,0	4,5	1,0	2,0	3,0	0,5	1,0	1,0
Staurolite	—	—	—	0,5	—	—	—	—	—	—	—	—	—
Andalusite	—	—	—	—	—	—	—	—	—	—	—	—	—
Disthene	—	Cn.	—	Cn.	—	—	—	—	Cn.	Cn.	Cn.	—	—
Weathered minerals (epidote)	—	—	—	7,7	—	—	—	—	—	—	—	—	—

[Legend: 1 = Traces.]