

Distribution and ages of Ashikule volcanoes on the West Kunlun Mountains, west China

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Abstract

On top of the towering West Kunlun Mountains there is Ashikule Basin 700km² in area, in which Ashikule, Wulukekule and Shagesikule Lakes are located and there are more than ten volcanoes with evident truncate scape, and tens of volcanelloes like hillocks around the lakes and in the east part of basin. They, together with 200km² of volcanic lava flow, form the Ashikule volcanic group including Ashi Shan, Dahei Shan, Wuluke Shan, Yueya Shan, Mati Shan and other main volcanoes. All volcanoes are more than 4650m above sea level. The highest, Dahei Shan volcano, is 5104.6m a.s.l. at the summit. According to volcanic morphology, petrology, and K–Ar dating, Ashikule volcanisms can be divided into six episodes from the end of the Pliocene to the present. The last volcanic eruption occurred on May 27, 1951.

1. Introduction

On top of the towering West Kunlun Mountains there is Ashikule Basin 700km² in area, surrounded by mountains in the form of a crescent. The bottom of the basin is high in the north and low in the south, high in the west and low in the east. It averages 4700m above sea level. Three salt lakes, Ashikule, Wulukekule and Shagesikule, like bright mirrors lie in the centre of the basin. More than ten volcanoes with evident truncate cones (Fig. 1) and tens of volcanelloes like hillocks and papules lie around the lakes and in the eastern part of the basin. They, together with 200km² of volcanic lava flow, form the Ashikule volcanic group. It was reported by a Xinjiang Daily on July 5, 1951 that a volcano erupted with a tremendous roar and smoke column on May 27, 1951, while soldiers were building a road nearby. That volcano still emitted smoke for some days. This volcano is listed as "Vulkan(Tibet)" (Simkin *et al.*, 1981). Afterward geologists found it and other three volcanoes, and called them number one, two, three and four (Zhao 1976). In fact, there were not only four volcanoes in Ashikule Basin. We have found fourteen main vol-

canoes and tens of volcanelloes (Fig. 2). These volcanoes almost erupted via a centre vent and formed truncate cones consisting of dense lava or porous lava, pumice and pyroclastics, which seem to be basalt, but they are actually trachyandesites rich in potash, based on identification and analysis. We have another paper on petrology. This paper will introduce volcanic form, distribution and ages that will influence glacial sediments as well as englacial particles. The previous volcano names, number one, two and so on, could not describe each volcano's character, so we gave each volcano a name based on volcanic scape and occurrence.

2. Distribution and form of volcanoes

Xi Shan volcano is the western most in Ashikule Basin, and located in desert south of Liuhuang Pass. It is in the form of a flat hillock with relative altitude of 25–30m and top and bottom diameters about 300m and 500m respectively.

Ashi Shan volcano (number one volcano) towered aloft in the black lava plateau south of Ashikule Lake, and has the form of a perfect truncate cone with a

crater 50 meters deep like a funnel, in which there are some fumaroles. The relative altitude of this cone is 120 meters and its top diameter is 120 meters, bottom diameter is about 350 meters, and volcanic cone slope is 30 degrees. The volcanic cone consists of purplish red pumice and stomatal lava, including a few gneiss xenoliths. Its last eruption occurred on May 27, 1951.

Dahei Shan volcano (number two volcano) is the biggest and highest in the Ashikule volcanic group. Its top is 5104.6m above sea level and relative altitude is about 400m. This volcanic cone consists of overlapping lava, separated into two parts by a crater of "v" shape, its two flanks of volcanic ridge stretch some kilometers to the southwest and southeast.

Wuluke volcano (number three volcano) has a



Fig. 1. The volcano in the West Kunlun Mountains.

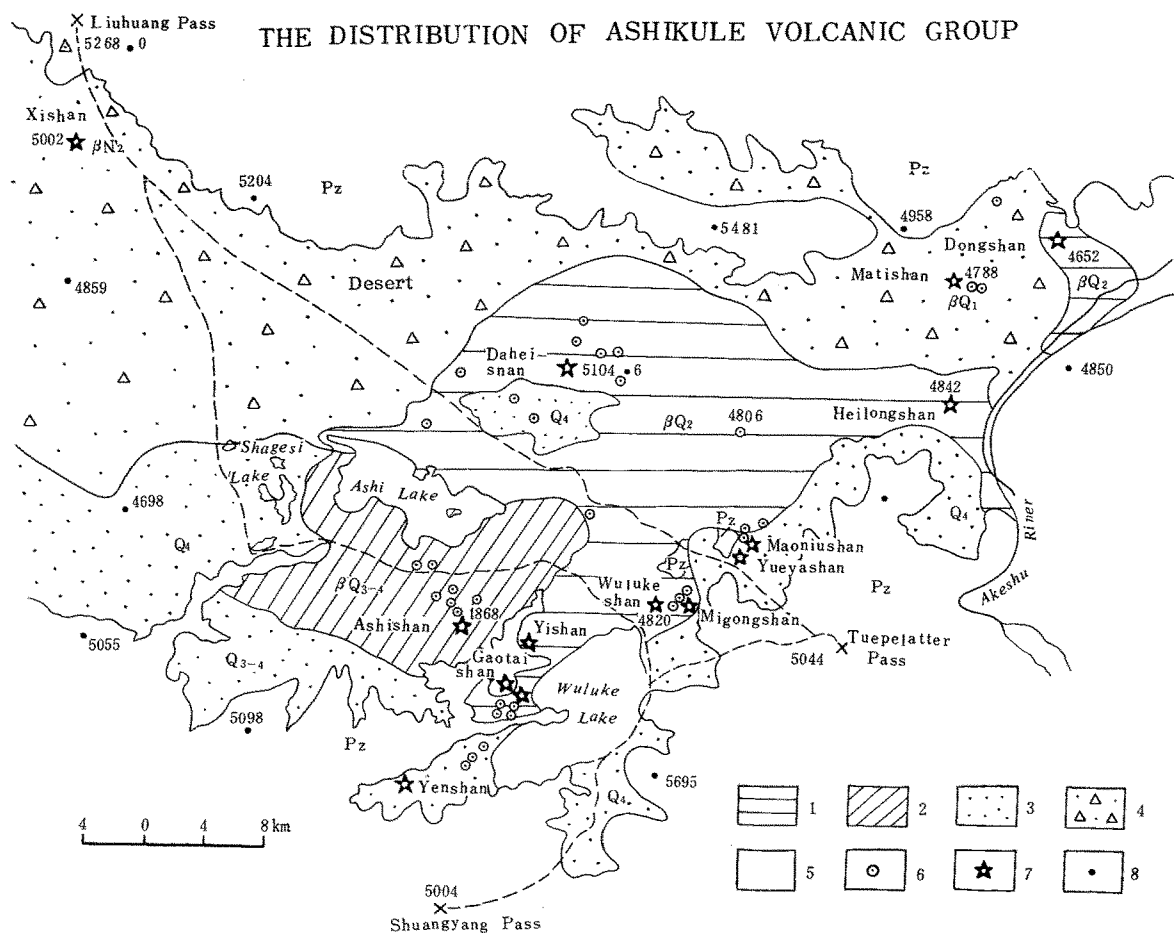


Fig. 2. Distribution of Ashikule volcanoes.

- Legend:
- 1. Middle Pleistocene lava flow(βQ_2)
 - 2. Late Pleistocene-Holocene lava flow(βQ_{3-4})
 - 3. Quaternary deposits(Q_{3-4})
 - 4. Desert
 - 5. Pre-Mesozoic
 - 6. Volcanello
 - 7. Volcano
 - 8. Altitude above sea level

perfect truncate cone with a crater in the form of a sloping dish, and is located northeast of Wuluke Lake. Its relative altitude is about 80m, top diameter is 100m and bottom diameter is about 300m. The lava flow around this volcano is connected with other lava flows around Ashi Shan and Dahei Shan volcanoes. Ashikule and Wulukekule Lakes were formed by a lava barrier.

Migong Shan volcano is adjacent to Wuluke volcano in the east, in the form of a dustpan open to the west. The crater wall is 80 meters high in the east, 30 meters in the west. The crater bottom is 150 meters long and 50 meters wide. Most of the volcanic cone is covered by soil.

Yueya Shan and Maoniu Shan volcanoes are located in the northeast, five kilometers from Wuluke volcano, Yueya Shan consists of a volcanic cone and a crescent crater around it. The crescent crater is about 300m long; the center cone is 60 meters high. Maoniu Shan volcano is adjacent to Yueya Shan. It is an elliptic flat hillock with 50 meter relative height and 150 meters top diameter. Around the two volcanoes were more than ten volcanelloes. They constitute a local volcanic cluster.

Heilong Shan volcano located on the west of the Akesu River is a black volcanic rock ridge ten kilometers long running west-east, 30–70 meters high and 400–500 meters wide. It forms a wide lava plateau covering the third terrace of the Akesu River and extends to the eastern part of the basin, where there are two other volcanoes called Dong Shan and Mati Shan. Dong Shan is a small flat volcanic hillock 7–8 meters high and 50–60 meters in diameter. Mati Shan is a horse-shoe volcano, located in desert, its relative altitude 65m. The top and bottom diameters of volcanic cones are 300m and 600m respectively.

Some volcanoes, such as Yi Shan, Gaotai Shan, Yin Shan and Binhu Shan lie in piedmont along the west side of Wuluke Lake. Except for Yi Shan, these were found by aerial photograph.

All of the above volcanoes are more than 4650 meters above sea level. As far as we know they are among the highest volcanoes in the World; only some volcanoes in Argentina and Chile can compare with them in height. However, their relative altitudes are not high, usually only tens to a hundred meters, except Dahei Shan which is of more than 400 meters high.

A large volcanic lava flow lies on the sixth terrace of the middle Keliya River in the Kangsu Lake area. It is about 120km north of Ashikule Basin. This

lava flow has two layers; the upper flow is 20 meters thick, covered by thick loess and sandy soil, which in turn are covered by fluvial deposits including gravel sand and soil; below it is a lower flow 7 meters thick. This lava flow also consists of trachyandesite rich in potash, which is very similar to that of the Ashikule volcanoes (Liu, 1988).

3. Ages of volcanic rocks and volcanic episodes

According to geological occurrence, geomorphic and rock features of the Ashikule volcanoes and Kangsulake lava flow, as well as potassium-argon dating (Table 1), Xi Shan volcano occurred on the eve of the Quaternary, the other volcanoes and lava flows wholly occurred in the Quaternary. The volcanisms can be divided into six episodes from the Late Pliocene to the present:

(1) Xi Shan episode, only Xishan volcano erupted 2.8Ma ago.

(2) Mati Shan episode, it erupted in the Early Pleistocene (1.63Ma) and formed Mati Shan volcano. Both Xi Shan and Mati Shan were located in desert in the northern part of Ashikule Basin. One is alone in the west, the other in the east. The two volcanic cones were almost covered by soil and became flat hillocks. There were no lava flows around them. It has been suggested that they occurred too early. The Kangsulake lava flow occurred between the Quaternary deposits, the lower flow 1.43Ma ago and the upper flow 1.21Ma ago, so they also belong to the Mati Shan episode.

Most volcanoes of the Ashikule volcanic group occurred in the Middle Pleistocene including three episodes.

(3) The Heilong Shan episode occurred in the Early Middle Pleistocene (0.67–0.50Ma). Most volcanoes such as Heilong Shan, Yi Shan, Dong Shan and Dahei Shan erupted in this episode. Dahei Shan erupted at least twice; the early eruption occurred 0.60Ma ago and formed the lower part of the cone; and the next eruption occurred 0.50Ma ago and formed the top crater.

(4) The Yueya Shan episode occurred in the mid-Middle Pleistocene (0.44–0.28Ma). This episode of volcanism wasn't intense and formed small volcanoes like Yueya Shan, Migong Shan, and volcanelloes consisting of pumiceous rocks, with only a little lava flow around the volcanoes.

(5) Wuluke episode (0.20–0.12Ma); during that

Table 1. K-Ar dating of Ashikule Volcanoes.

No.	Place	Latitude (N)	Longitude (E)	Weight (g)	K %	40Ar*		age & error (Ma)	
						E-12 moles/g	%		
K713	Migongshan	35°41'58"	81°39'45"	11.8016	3.07	2.2432	1.94	0.42±0.01	0.44±0.01
						2.4077	1.93	0.45±0.01	
K716	Wulukeshan	35°42'	81°39'	10.0067	3.44	1.1797	3.67	0.20±0.05	
K718	Volcanello near Migongshan	35°42'	81°39'40"	10.0448	3.48	1.7706	12.37	0.29±0.01	0.28±0.01
						1.7151	11.71	0.28±0.01	
K720	Heilongshan	35°45'17"	81°41'40"	10.9389	3.07	3.6435 3.5110	4.55 4.41	0.68±0.01 0.66±0.01	0.67±0.01
K721	Matishan	35°47'26"	81°45'40"	10.0487	3.12	8.9242	10.63	1.65±0.16	
K723	Dongshan	35°48'17"	81°48'	10.7627	2.99	2.7367	5.08	0.53±0.01	0.52±0.01
						2.6532	4.96	0.51±0.01	
K729	Yishan	35°41'25"	81°36'12"	11.3912	3.60	3.6962	2.36	0.59±0.01	0.58±0.01
						3.5576	2.31	0.57±0.01	
K732	Yueyashan	35°42'45"	81°40'53"	10.2983	3.48	1.8873	1.42	0.31±0.01	
K736	Daheishan (mid.)	35°46'15"	81°37'	8.6592	2.92	3.0904	19.73	0.61±0.01	0.60±0.01
						3.0451	19.54	0.60±0.01	
K738	Daheishan (top)	35°46'5"	81°36'30"	8.0032	2.88	2.5029	3.88	0.50±0.13	
K740	West lava of Ashishan	35°42'	81°30'	16.7597	3.82	0.7697	3.02	0.12±0.002	0.12±0.002
						0.8260	3.11	0.12±0.002	
K743	Xishan	35°50'39"	81°26'30"	8.0082	3.73	18.1133	50.0	2.80±0.06	
U601	Kangulake lava (upper)			5.9960	3.54	7.3038	24.19	1.19±0.02	1.19±0.02
						7.2767	24.13	1.19±0.02	
U606	"			5.1629	3.69	7.8539	27.36	1.23±0.04	
U604	Kangulake lave (lower)			6.0762	3.46	8.5719	49.84	1.43±0.03	

Note: *Radiogenic argon, (1) All samples are whole rock of trachyandesite, (2) potassium analysis by flame meter, and argon measured by RGA spectrometer, (3) Constants: $\lambda_e = 0.581 \text{ E-}10 \text{ year}^{-1}$, $\lambda_\beta = 4.962 \text{ E-}10 \text{ year}^{-1}$, $40k/k = 1.167 \text{ E-}4$ (atoms)

time the Wuluke volcano erupted and formed a perfect cone and wide lava plateau.

(6) The last volcanic eruption occurred on May 27, 1951. As far as we know, except for Kekexili volcano in western Qinghai Province which erupted on July 16, 1973 (Simkin *et al.*, 1981), Ashi Shan volcano is the newest one in China.

To sum up the Ashikule volcanic group covered six volcanic episodes:

1. Xi Shan episode (2.8Ma), 2. Mati Shan episode (1.63–1.21Ma), 3. Heilong Shan episode (0.67–0.50Ma), 4. Yueya Shan episode (0.44–0.28Ma), 5. Wuluke episode (0.20–0.12Ma) and Ashi Shan episode (Holocene). The early volcanoes underwent much weathering and denudation, and most of the volcanic cones were covered by soil. The newer volcanoes are more perfect in form and covered by less soil than the older ones.

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