

Investigation on Funatsu Tainai lava tree molds in Kenmarubi-I lava flow

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[Introduction]

Funatsu Tainai lava tree molds are a national natural monument located in the midstream area of Kenmarubi-I lava flow, and their measurement and investigation were carried out by K.Ogawa of Speleological Society and published as Yamanashi-ken natural monument urgent investigation report¹⁾. The investigation is continued and new additional lava tree molds are found and named as Yamanashi-ken monument important material by NPO Vulcano-Speleological Society. The volcanologic knowledge obtained from the current state of those investigations will be reported.

[The lava flow thickness and yield strength]

Funatsu Tainai lava tree molds count many vertical lava tree molds among which main natural monument and monument important material are listed in Table.1. The depth of the vertical tree mold are between 2.1m and 5.4m. Most has 4 m-5 m of depth as shown in Table.2. A diameter of a tree in this area was at most 1.9 m. The depth of the vertical lava tree molds shows a lava flow thickness. H , and gradient angle α in this area is approximately 8 degree, so the Bingham yield strength: f_B can be estimated as $f_B = 6.9 \times 10^4 \sim 1.9 \times 10^5 \text{ dyne/cm}^2$ from lava flow critical condition: $H = f_B / (\rho g \sin \alpha)$ of simple lava flow where $\rho = 2.5 \text{ g/cm}^3$ and $g = 980 \text{ cm/sec}^2$. This f_B is regarded as the proper value as basaltic lava of SiO_2 50.88wt% (Tsuya⁴⁾) or 51.1% (Takada⁵⁾), though it seems a little bit high because of the temperature fall at this area. This value agree with estimated value $5.0 \times 10^4 \sim 1.5 \times 10^5 \text{ dyne/cm}^2$ by Yamashita⁶⁾. Therefore Kenmarubi-I lava flow can be regarded as a simple lava flow defined by Walker^{7,8)}.

[Lava rib structure and surface tension estimated in Tainai]

Funatsu Tainai shows a complex lava tree molds which include lava stalactite from the ceiling and the ribbed wall formed by re-melting inside it⁹⁾. It's possible to estimate the surface tension of the lava from the pitch of the lava stalactite and ribbed wall¹⁰⁾. From instability onset conditions of melted liquid thin film, pitch(wave length) is shown as $P = 2 \pi (\gamma / g \rho)^{1/2}$, where γ is the surface tension of the lava and g is the gravity, and ρ is the density of the lava. Therefore it's possible to estimate a surface tension $\gamma = P^2 g \rho / 4 \pi^2$ by measuring P of lava stalactite which hangs down from the ceiling inside the Tainai or from ribbed structure of side wall. The pitch obtained from Funatsu Tainai indicated in Fig.1 is $P = 3 \sim 4 \text{ cm}$ approximately, then, $\gamma = 560 \sim 990 \text{ dyne/cm}$ is obtained as the surface tension. It's the reasonable value as surface tension of basaltic lava.

[Conclusion]

Similar results of yield strength and surface tension are also obtained for the Yoshida Tainai lava tree molds in the lava flow of Kenmarubi-II(SiO_2 51.2wt%⁵⁾). Kenmarubi-I and the Kenmarubi-II are regarded as a simple lava flow. These lava flows has so low thickness that could not make a lava tube cave. Without being buried, much of lava tree molds are left. So, the biggest complex lava tree mold in the world exists in this area³⁾. On the other hand, Aokigahara lava flow which has thick lava flow and high flow rate making a lot of lava tube caves indicates a compound lava flow. Further researches and investigations are under going for both Tainai lava tree molds.

References:

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Keywords: Lava tree mold, Kennmarubi-I lava flow, Funatsu tainai

Table.1 船津胎内縦樹型の深さと直径
(文献1) から縦樹型のみを抽出したもの)

船津胎内縦樹型番号	深さ	直径
No. 1	3.0m	1.3m
No. 3	4.9m	0.6m
No. 4	4.9m	0.9m
No. 5	3.0m	1.3m
No. 6	4.0m	1.2m
No. 7	3.6m	0.9m
No. 8	3.9m	1.2m
No. 10	4.3m	1.5m
No. 12	4.3m	0.6m
No. 14	4.9m	0.6m
No. 18	5.4m	1.0m
No. 19	4.8m	0.8m
No. 21	4.0m	1.2m
No. 24	3.0m	1.3m
No. 25	5.2m	0.8m
No. 26	4.6m	0.6m
No. 29	3.3m	1.3x2.7m
No. 38	2.1m	0.9m
No. 39	2.3m	1.6m
No. 40	2.3m	0.3m
No. 41	2.9m	1.6m
No. 42	4.9m	1.3m
記念物重要資料 No. 3	3.9m	1.1m
記念物重要資料 No. 105	2.9m	1.9m

Table.2 船津胎内縦樹型の深さと本数の分布

縦樹型の深さの範囲	樹型の本数
2.0m-2.9m	5
3.0m-3.9m	7
4.0m-4.9m	10
5.0m-5.4m	2

Fig.1 船津胎内の肋骨状溶岩とピッチの計測

