MORPHOLOGIC CHARACTERISTICS OF THE VALLIS SCHRÖTERI. C. Honda[1], T. Morota[1], Y. Yokota[1], Y. Ogawa[2], H. Demura[3], N. Hirata[3], T. Matsunaga[2], M. Ohtake[1], J. Haruyama[1], [1]Japan Aerospace Exploration Agency, 3-1-1, Yoshinodai, Sagamihara, Kanagawa, Japan, 194-0212, [2]National Institute for Environmental Studies, [3]The university of Aizu, E-mail: chonda@planeta.sci.isas.jaxa.jp

Introduction: The Vallis Schröteri exists on the Aristarchus Plateau (305-313 °E, 22-30 °N) which is a topographic high surrounded by basaltic maria. The rille appears a singular sinuous rille as meandering primary rille including a more meandering inner rille. Typical sinuous rilles are 20 to 40 km in length and less than 1 km in width [1], however, the primary rille of Vallis Schröteri has been reported to be 125 km in length, up to 4.5 km in width, and 400 m in depth [2], and inner rille which is originated from the cobra-head of primary rille is reported to be ~170 km in length, 640 m of average width, and 95 m in depth [3].

The Vallis Schröteri exists on the highland which represents the crustal material of the Moon; so, the negative relief of this rille on the Aristarchus Plateau with no apparent levees and large width must be originated by the thermal and/or mechanical erosion of turbulent and sustained lava flow. We quantitatively define the physical properties of the turbulent lava flow to produce the Vallis Schröteri. The erosion rate into the substrate ground has been estimated by modeling of our turbulent lava flow. Our goal of this research is to evaluate the erosional effect of the emplacement of lunar lava flow, and to make variations of parameters such as effusion rate and volcanic temperature constrain by comparing our results of our modeling and actual morphology such as depth profile as a function of distance from vent-like feature.

Data: The digital terrain model (DTM) is derived from the stereo pair of images of Terrain Camera (TC) with 10 m spatial resolution and 10 bits quantization on the Kaguya lunar satellite which was launched at the September, 2007. The TC has two cameras with slant angle of ± 15 °, so the base-height ratio observed from nominal 100 km altitude is 0.57. Consequently, the accuracy of DTM derived from the base-height ratio is 17 m [4]. Figure 1a, b show the mosaics of southern-west part of the Aristarchus Plateau and the DTM of same area. The mosaic data is orthorectified as the Transverse Mercator (TM). The value of height reveals the distance from the center of figuration of the Moon. We can recognize the whole of inner rille without hidden area by topographic shadow because of high incident angle of the sun-light (around 40 °).

Morphology: The depth of a rille are thought to be key morphological parameters that may be closely associated with the formation of this rille. Using the DTM of TC, we measured the depth which was derived from subtracting floor's height of Vallis Schröteri from rim's height (surrounding ground's height) of this rille as a function of distance from vent-like feature which is usually in a circular crater or in an elongated crater, sometime called a "cobra head crater" (Fig. 2).

The primary rille of Vallis Schröteri has been reported to be 125 km in length, up to 4.5 km in width, and 400 m in depth [2]. Using newly acquired data, the more accurate aspects of primary rille of Vallis Schröteri are 155 km in length from end to end, up to 6.0 km in width, and 500 m in depth (up to 750 m). *Garry et al.* [3] reported that the narrow inner rille which extends to outside of the Aristarchus Plateau from inside of primary rille is ~170 km in length, 640 m of average width, and 95 m in depth. Our data suggests that the aspect of inner rille is ~240 km in length except for the lacking in its feature, 1.0 km in width, and 150 m in depth.

As seen in Fig. 2, the height of the floor of Vallis Schröteri increases in the range of more than 60 km in distance, meaning that the lava flow ascends toward a higher elevation at the later stage of lava flow drainage. Yet unless the lava has extremely high momentum, it is impossible for lava to flow uphill over a range of a few tens of kilometers. The current averaged slope of the substrate ground which is derived from rim's height is estimated to be 0.2°. On the other hand, the current averaged slope of the floor in the range of more than 60 km in distance is estimated to be - 0.1° which means the increasing of floor's height toward the end of stream. It might reveal that the ancient Aristarchus Plateau after the formation of Vallis Schröteri declined more than 0.1°. Basically, the slope of the substrate ground along the stream had been more than 0.3° at the formation of Vallis Schröteri. Therefore, we must be alert for evidence of such late-stage tectonic movements as we examine the formation process of the lunar rilles. The DTM data is useful for detecting such tectonic movements.

The streamline of inner rille of Vallis Schröteri is cutting a wall of larger primary rille (Fig. 1b). We suppose that the lava flow to produce the inner rille could be a second stage event after formation of the primary rille. Since the lava flow to form inner rille should not override the wall of primary rille, the cutting represent evidence of tectonic mechanism such as crack of ground. According to *Spudis et al*. [5], the lava flow that formed the Hadley Rille ran along a stream of normal faults, cracks, grabens, and collapse features produced by regional tectonic deformation caused by the Imbrium basin adjustment. In contrast, *Raitala* [6] assumed that lunar sinuous rilles are related to tectonic features such as mare ridges since the lunar sinuous rilles are parallel to the mare ridges. After all, lunar sinuous rilles might be associated with the coupling of the thermal erosion of lava flow and the tectonic structure in a few cases. The possibility that lunar sinuous rilles are produced by coupling of the thermal erosion of the lava flows and the tectonic structure remains.

References: [1] Schubert, G. et al. (1970) *Rev. Geophys. Space Phys.*, *8*, 199-224. [2] Gornitz, V. (1973) *The Moon*, *6*, 337-356. [3] Garry, W. B. et al. (2008) *LPSC XXXIX*, Abstract #2261. [4] Haruyama, J. et al. (2008) *Earth Planets Space*, *60*, 243-255. [5] Spudis, P. D. et al. (1988) LPS XVIII, 243-254. [6] Raitala, J. (1980) *The Moon*, *23*, 307-321.

(a) (b)

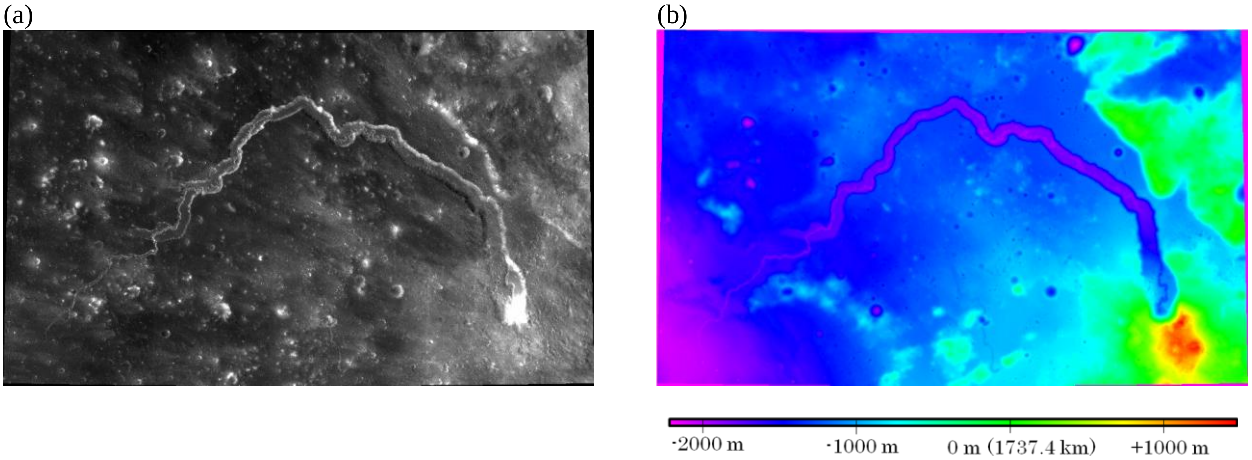

Figure 1(a) Mosaic map of Vallis Schröteri on the Aristarchus Plateau (TM). The map covers area of 24 – 27 °N, 306 – 312 °E. **(b)** DTM map of same area (TM). The scale of this figure reveals at the bottom.

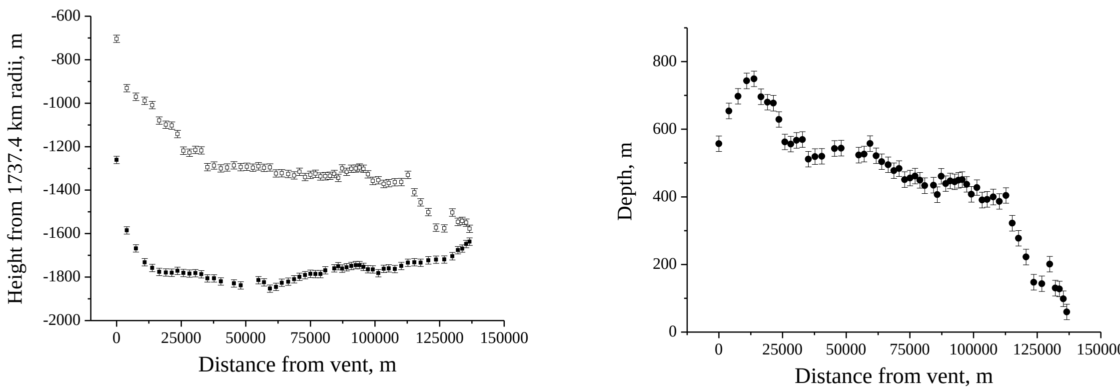

Figure 2 Rim and floor heights, and depth profiles of Vallis Schröteri as a function of distance from the end of vent-like feature except for the vent. The open and solid squares reveal the rim and floor heights, respectively. The solid circle reveals the depth of Vallis Schröteri. The value of depth error is 23 m.