SHALBATANA VALLIS (MARS) : HEADWATER MIGRATIONS AS AN ALTERNATIVE TO RECHARGE PROCESS. **N.A Cabrol [1],E.A Grin,[1], G. Dawidowicz[2], [1] NASA Ames Research Center, Space Science Division, CA, 94035-1000 ; [2] Universite de Paris-I (France)**

The challenge to understand the origin and history of valley erosional morphologies requiring extensive flow rate by water recycling [1, 2] to maintain their hydraulic gradients is not successful met. Matching the morphometry [3,4] of relic fluvial landforms with the organization of their valley paths may emphasize the range of the genetic process and allows hydrogeologic response to the debated major question of aquifer recharge. The erosional unconformity of the three segments (1), (2), (3) in the middle course of Shalbatana vallis , a Chryse Basin outflow, (see figure 1a) illustrates a process of successive abandonned valleys [5]. The comparison between their cross section profiles (fig. 1b) gives clues to understand the flow discharge episodes according to the conformity between each valley section and their relative elevation.

The respective floor elevations of the three segments of Shalbatana vallis clearly show that neither or each three segments are tributaries from one to another but are the relic of successive course of a same spring systems at various epochs. Furthermore, this relationship of elevation and section for the three segments allows to work out their history. The narrow valley segment (1) is a remnant of the prestine course of the stream. The segment (2) -which cross section area is about three times the first one- is at an intermediate level between the pristine valley and the wider flat floored valley (3), see fig.1b.
Given a conservative 0.002 valley floor gradient for each segment, their respective idealized graded profiles intercept the plateau level profile [6] at each potential headwater spots, see fig.1c. Considering the floor of each valley segment as base level at a depth -estimated by shadow length measurements- respectively at :

Valley segment	depth (m)	terminus/headwater distance (km)	Headwater. coord Lat°	Long°
(1)	300	150	+8	42
(2)	800	400	+2.4	42.8
(3)	1200	600	0	45.5

These peculiar locations are in fairly good agreement with the observed remnants of isolated chaos material inside Shalbatana vallis. While the chaos related to segments (1) and (2) have been partially washed away, the relatively light eroded 100 km diameter upstream chaos of segment (3) [7] can be straongly assumed to be the later headwater of Shalbatana vallis. These three chaos which have initiated the different segments of Shalbatana vallis at various epochs are on the border of the east swell of Tharsis volcanic complex. These peculiar region is distinguished by a wide field of sublinear ridges forming a great arc. The alignment of the three chaos is in conformity with the orientation of the ridges.
Conclusion : The erosional unconformity of the abandoned segments suggests an alternation of decays and reactivation of Shaltana vallis at different elevations through time, with regression of headwater systems, corresponding to the discharge of a same aquifer. The abandoned segments at successive elevations illustrate the achievement of the stream to establish a longitudinal graded profile between the base level and the headwaters. As the headwaters migrated upstreamward, the valley segments length increased as well as their depths. The correlated arrangement of the Shalbatana vallis chaos with the orientation of the sublinear plateau ridges suggests that episodic hydrothermal processes have generated the chaos. This illustrates the relationship between volcanic complexes and formation of valleys by hydrothermal circulation [8]. The migration of the headwater chaos is a result of the decay of the hydraulical potential that implies that the rate of flow is subject to the amount of water within the boundary of the heatflow diffusion effect. The resulting episodic phases and wide range of stream flows are caused by repetitive endogeous subsurface plumes warming preexisting aquifer reservoirs until their extinctions. This mechanism do not require any recycling recharge of the aquifer by atmospheric process.

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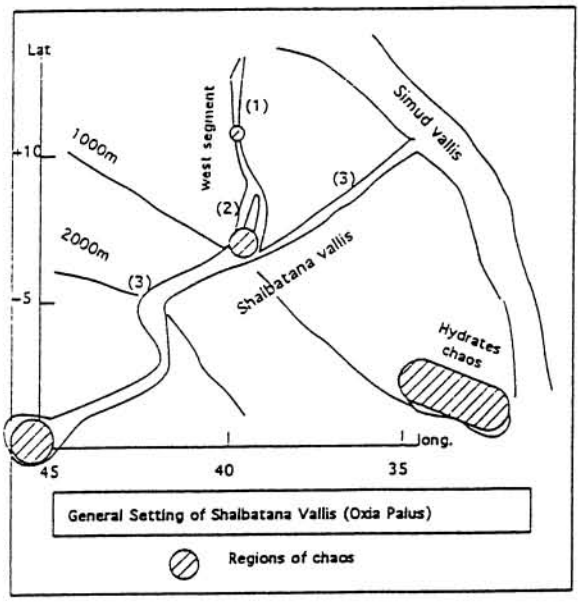

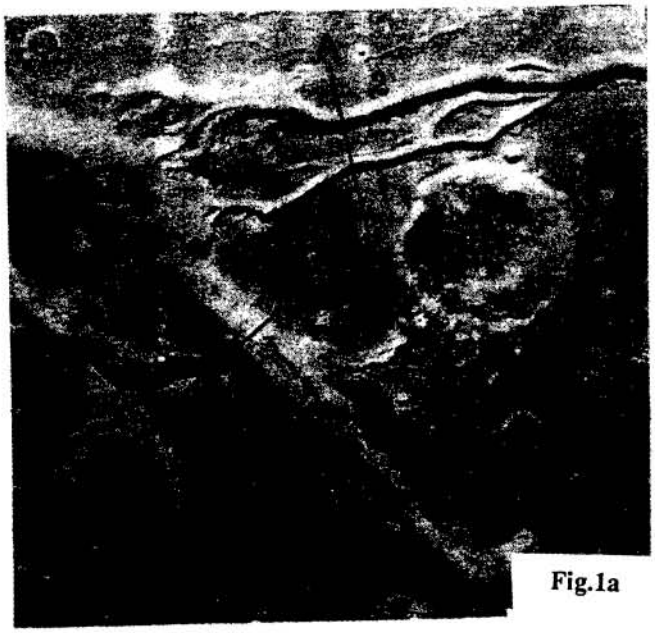

Fig.1a

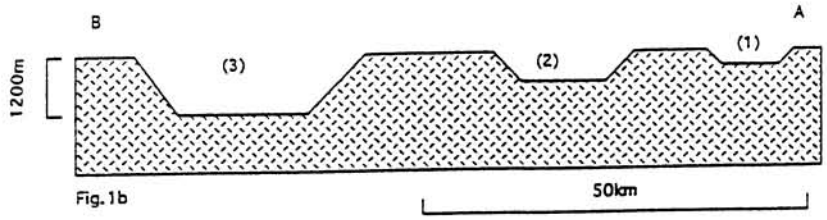

Fig.1b

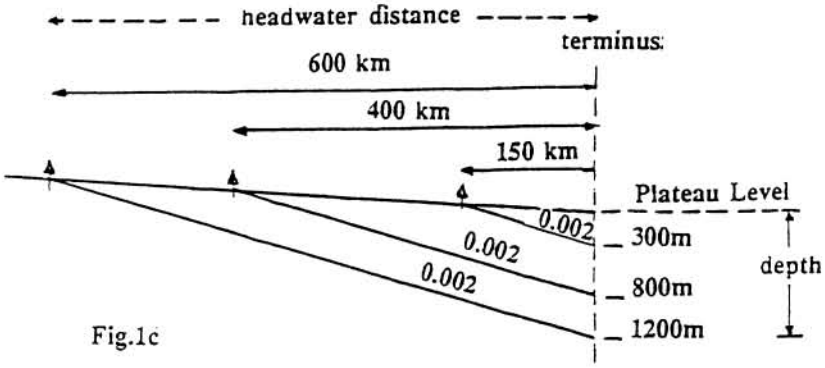

Fig.1c