**REUYL CRATER, MARS: INSIGHTS FROM FLUVIAL ACTIVITIES.** S. Vijayan¹ and Rishitosh K Sinha¹,

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**Introduction:** Craters with fan/delta deposits on their floors have provided direct evidence for fluvial activity on Mars [1]. In some cases, formation age of the crater acts as a chronology for deciphering the fluvial activity. In addition, hydrous mineral detected along/over these fan/delta deposits also postulates fluvial related formation scenario [1]. Although, despite this correlation, a mineralogical, geological and chronological study is required to decipher 1) whether they are excavated ancient crustal materials, 2) transported sediments during fluvial activity and 3) in situ derived post crater formation [1-3]. Though several Noachian to few Amazonian craters with preserved channels and alluvial fans have preserved [4] the consensus and quest for the source and its interrelationship continues. In this context, adding to the existing list of crater studies with fan/delta deposits, we present new observations of multiple distributary fan/delta deposits in Reuyl crater located along the dichotomy boundary (west of Apollinaris Mons). This new crater candidate with fluvial morphological units preserved on the floor lead to understand the nature of fluvial processes.

**Study area:** Reuyl crater (9.6°S, 166.9°E) diameter and depth is ~84 km and ~2.6 km respectively (Fig.1a). To the south east, the Gusev crater is located with delta deposits on its floor [5]. To the south, lies possible deposits of Al-Qahira Vallis system. Other sides of the crater are covered by resurfaced units, either volcanic or sedimentary origin. We used the MRO-CTX and -HiRISE images for the geological mapping. We carried out the crater counting over the Reuyl ejecta blanket and over the fan deposits to decipher the relative period of fluvial activity. Fluvial features within the crater shed insight on fan formation, episodic nature of channeled flow, and context of an integrated and superposed fluvial system.

**Geomorphology:** Reuyl crater is a typical multiple layer ejecta crater with several superimposed ejecta layers extending up to ~4 crater radii from the rim. The ejecta has undergone erosion after its formation, predominantly over the eastern part of the crater. Whereas, in southwest side of the crater several secondary crater chains are observed. On examining the central peak of the crater, it appears as a mound of light-toned deposits, comprising of layered material [6]. The spatial extent of central mound is ~2.5 crater radii. Although, the current form of the mound appears as if it has been eroded and covered by significant amount of dust mantling the underlying units.

Nearly, more than 10 fan deposits are apparent, which seem to be associated with channel networks over the crater walls (Fig.1a). In most of the fan deposits, distributaries with dendritic pattern are observed (Fig.1b,c). Herein, intermediated gravel center bed is exposed after finer bed materials had been eroded [4]. The center bed distributaries are possibly composed of coarse grained gravels that are resistant to erode further. The differential erosion within the region left traces of elevated bedforms around the tributaries exposing the sediment thickness.

Apart from this, at least two prominent alluvial fan deposits with meandering channels, but currently in inverted form are present on the floor (Fig.1d). These two alluvial fan deposits are almost perpendicular to the steep walled scalloped alcoves, where the majority of other fans originated. The floor region typically looks like a valley region, because it lies in between the elevated crater wall and central peak region. This valley like landform acted as a conduit possibly for meandering and its associated fan deposits. The channels on the floor are preserved with the typical meandering pattern, which likely formed due to the least resistance path during the flow. Further detailed analysis will help to understand the possibility of meandering either due to the confined valley or due to constant discharge. In addition, the fan deposits on the floor have cross-cutting superposed deposits (Fig.1e) directly from the wall, which reveals their possible episodic formation within the crater [7]. This superposition of fan implies that the floor fan deposits source is further away from its current deposits suggesting the continuous supply of sediments for their formation.

Each fan deposits comprised of multiple small to broad ridges with sinuous nature, which stacked one above the other and well-developed tributaries. Multiple fan deposits are observed on the floor, while few of their peripheries are superposing the existing fan deposits suggesting possible episodic formation (Fig.1a,e). Most of the fans originate from the wall of the crater leaving an eroded alcove and none of the flow emerged from outside the crater rim. Alluvial fan deposits over the floor cover most parts of the crater except the northern part. Among the floor, the S-SW part holds the lowest elevation, which possibly favored the topographically controlled flow to converge over this region.

Polygons are widely observed from SE to SW side of the crater floor and likely resemble desiccation crack polygons (Fig.1f) [8]. In addition to the floor, the poly-
gons are observed over the distributary fans networks over this region (Fig. 1f). The thick dust cover and erosional activity probably covered the polygonal setting within other parts of the crater floor.

**Discussion:** Crater chronology over ejecta blanket revealed the crater formation age as ~3.63 Ga (Fig.1g). Though craters are counted over all the fan deposits, the age estimated for fan deposits in Fig. 1b,c leads to a model age >3 Ga (Fig.1g). This suggests that the fluvial activity could have occurred after the crater formation. The temporal difference between individual fan formation and their superposition over the floor reveals the complex emplacement process. Preliminary model mineral identification over the floor reveals that it is comprised of pyroxenes and olivine dust [9]. Lack of CRISM coverage and high dust cover over the polygonal area hinders the mineral identification currently. The central mound also shows channels and fan like deposits. Overall, the channel networks suggest that different source like ground water/ice or snow melt [10] could be even possible for the fan formation within the crater. The geological situation in this crater has advantages for estimating time of fluvial system, because meandering and overlapping deposits suggests continuous supply of water for their formation. The extensive fan morphology within the crater and lack of such channels/fans outside crater suggests that the fan formation might be related to the impact event. The Gusev and Gale crater are located to the East and West side of Reuyl respectively. Though they are spatially distinct, the presence of fluvial deposits within those craters and over Reuyl implies extensive fluvial activity along the dichotomy region of Mars.


**Figure 1.** a) Reuyl crater with interior fan like deposits (yellow), channels over the wall and central mound region (black) and inverted channels on the floor (blue). b) Alluvial fan deposits with dendritic patterned distributaries and superimposed craters (v.e=5), c) multiple alluvial fan deposits on the floor with channel networks emanated from crater wall (v.e=5), d) meandering channel (yellow arrow) and associated fan deposits on southern side of the crater, whose orientation is perpendicular to the southern wall. The spatial extent of the channel suggests consistent supply of sediments to flow over the floor, e) location marked in (d), the alluvial fan on the floor superimposed by another fan deposits possibly implying their episodic formation and shows polygonal cracks, f) location marked in (a) shows typical polygonal cracks of variable sizes and with patterned orientation, g) crater size frequency distribution of Reuyl crater ejecta and fan deposits within the crater floor.