Comparison of Floor Fractured Craters- a Case Study for Mars M. Bamberg[1,2], T. Kneissl[3], G.G. Michael[3], R. Jaumann[2,3] and H. Asche[1] [1]University Potsdam, Department of Geography, Geo-Information Section, Germany [2]German Aerospace Center, Institute of Planetary Research, Berlin, Germany [3] Free University Berlin, Department of Earth Sciences, Institute of Geosciences, Remote Sensing of Earth and Planets, Germany. (Marlene.Bamberg@dlr.de/ Fax: +49 30 670 55 402)

Abstract: Floor-Fractured Craters (FFC) are mainly distributed along the dichotomy boundary of Mars. Their different appearance suggests that various geologic processes are involved in the modification of this crater type. We compare FFC with respect to their location, age and observed surface features to understand their origin, the involved processes and the implications for the geologic history of Mars.

Introduction: Floor-Fractured Craters are characterized by the distinct appearance of their floors, which exhibit fractures, mesas and polygonal features.

FFC are located in different regions on Mars (Fig.1), with a particularly high spatial density along the dichotomy boundary-between the southern highlands and northern lowlands. They are also observed in Arabia Terra, Syrtis Major and on the plateaus around the chaotic terrains east of Valles Marineris. In the southern highlands, only few individual FFC can be identified. 47.500 impact craters (>5 km) have been found on the Martian surface [1], FFC make up 1-2% of these craters on Mars.

Here we compare two craters, A and B, which are located near the Nili Fossae region and in the Libya Montes, respectively.

Geologic Overview: Crater A is located west of the Nili Fossae region near the dichotomy boundary (Fig. 1). A mantling unit was deposited in the Arabia Terra region in the Late Noachian or Early Hesperian. Removal and erosion of those materials appears to have been 3.5 Ga ago [2]. In the Arabia Terra region etched terrain is prevailing. The terrain is characterized by a layered mantling unit and relief inversion [3].

The area is highly eroded and the age of the crater can be dated to 4 Ga. The crater has a diameter of 90 km, the central peak and the rim are completely eroded. Channels extend from the crater into the northern lowlands and to the surrounding plateaus and adjacent FFC (Fig. 2a). Layered deposits, ridges and linear features have been observed in the crater [2].

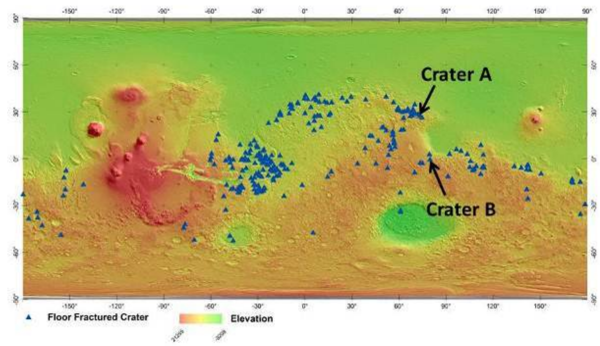

Figure 1: Distribution of Floor-Fractured Craters on Mars [4 modified]. Crater A is located at the dichotomy boundary (29.3°N, 70.4°E) - Crater B is located near the equator (-0.2°N, 79.7°E).

Crater B is 47 km in diameter and located south of the large volcanic center of Syrtis Major (Fig. 1). Syrtis Major was active from the Early Hesperian to the middle Amazonian [5]. The lava flows border the eastern rim of the crater. The crater interior is filled with basaltic deposits [6]. A fracturing system with radial branches around the central peak can be observed (Fig. 2b). Crater size-frequency distribution measurements, which we conducted (Tab. 1), indicate that the impact occurred at the Noachian- Hesperian boundary.

Comparison of FFC: The results of the crater comparison are summarized in Table 1. Both craters are filled. Sediments or air fall deposits could cause the layering of the infilling material in Crater A. Furthermore, linear features (potential exhumed dikes [2]) and avalanches (Fig. 3a) can be found there. Based on thermal inertia, surface texture and age, the partially filling of Crater B is similar to the lava deposits outside the impact structure (Fig. 3b). No evidence of fluvial or glacial activity could be identified in this area.

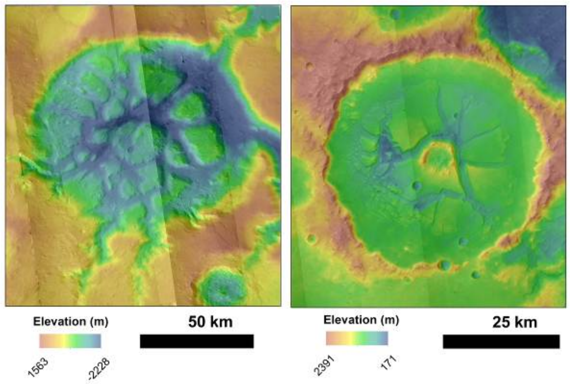

Figure 2: CTX-image mosaics overlain by color-coded HRSC topography for (a) Crater A and (b) Crater B.

Table 1: Observed surface features and age dating of surface units in Crater A and B. Buffered Crater counting has been done for the area inside the fractures and can provide a maximal age for the fracturing event [7].

	Crater A	**Crater B**
Surface Features	Glacial Aeolian Fluvial Hydrothermal	Volcanic Aeolian
Fractures		
Arrangement	Concentric & radial branches	
Appearance	Smooth	Sharp borders
Width	4000 m	1230 m
Age	3.40 Ga	3.81 Ga
Knobs		
Diameter	1320 m	620 m
Height	725 m	175 m
Layering	Mesas	-
Linear Features	X	-
Fretted Terrain	X	-
Inversion	X	-
Age	3.80 Ga	3.97 Ga
Surrounding		
Lava Flows	-	1.55- 2.85 Ga
Fretted Terrain	3.50 Ga	-

Conclusion: FFC can be found with a particularly high spatial density in different places on Mars. This research aims to find out the conditions which lead to the formation of fractures in the crater floor. Crater A and B are both fractured but different surface features can be observed in detail. By explaining the involved geologic processes and chronology the cause of fracturing can be explored. Furthermore the crater size-frequency distributions show that fracturing processes occurred in the Hesperian and Amazonian.

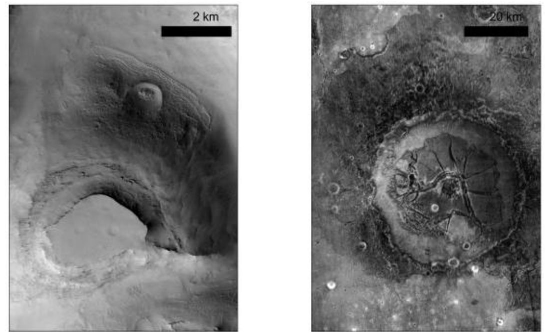

Figure 3: (a) A detailed view inside Crater A shows a mesa and layered deposits. An avalanche can be observed at the northern flank of the knob. (b) Thermal inertia of Crater B observed by THEMIS-IR.

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