

NEW INSIGHTS ABOUT CATARACTS (DRY FALLS) ON THE FLOOR OF KASEI VALLES, MARS. Neil Coleman and Steve Lindberg, University of Pittsburgh at Johnstown (Department of Energy & Earth Resources, Johnstown, PA 15904; ncoleman@pitt.edu; slindber@pitt.edu).

Introduction: Spectacular cataracts (dry falls) on the floor of Kasei Valles have been described by *Davatzes et al.* [1] and *Coleman* [2]. Here we examine cataract group “C” which has not previously been described. The headwall area is 90 km WSW of Sharonov Crater (Fig. 1).

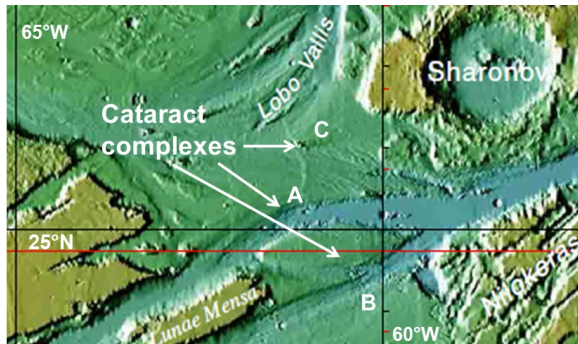


Fig. 1. Regional context for three large cataract complexes, labeled Kasei “A,” “B,” and “C” following prior designation by [2] (no IAU names exist for cataracts). Scale: diameter of Sharonov Crater = 100 km. Map source: [3].

Three large cataract complexes can be seen in Fig. 3. “A” and “B” were eroded by flow in the southern Kasei channel, which is bisected by the mid-channel “island” Lunae Mensa. The headwalls for these cataracts migrated upstream from the area south of Sharonov Crater (Fig. 1). Complex “C” was formed by flow in the northern Kasei channel that was diverted and crossed over into the southern channel. MOLA data (Fig. 2) show that the headwalls are 250-400 m high.

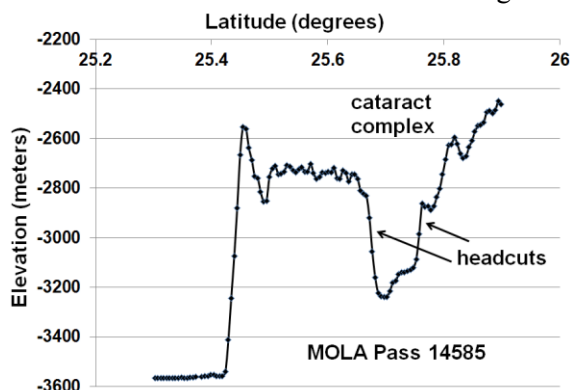


Fig. 2. Topographic profile across cataract complex “C” (VE = 25X). Profile location is shown in Fig. 3.

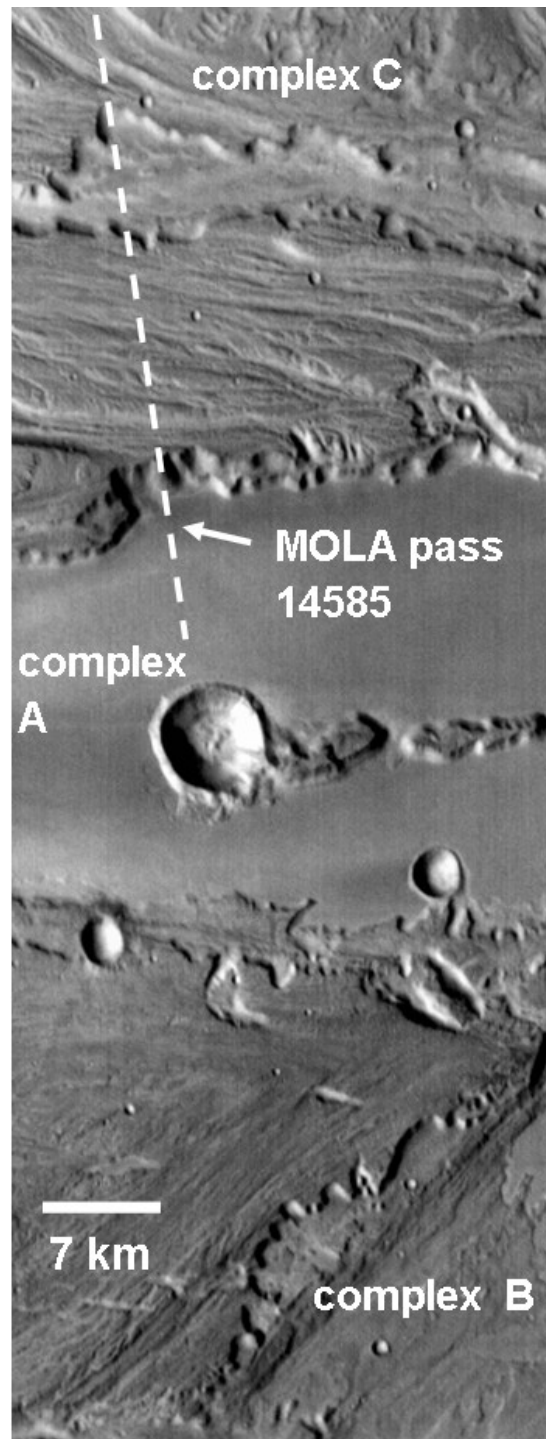


Fig. 3. Three cataracts in the channels of Kasei Valles. THEMIS daytime infrared image I35869014 [4]. See THEMIS image V11935006 [4] to view the same features in visible light.

The amphitheater headcuts for cataract complex “C” migrated upstream at least 60 km from their inception point. The channel north of complex “C” became a “hanging” valley when it in turn was partly crosscut by the channel flow that formed the cataract (Fig. 4).

Discussion: The cataracts of Mars provide some of the most powerful evidence that the outflow channels were formed by megafloods. When these channels were first seen in Mariner 9 images researchers speculated that the thin atmosphere may have required processes other than aqueous floods to create them. However, such early and outmoded views that the outflow channels were formed by wind erosion, lavas, liquid CO₂, CO₂-supported debris flows, or glaciers represent imaginative, alternative concepts that fail in the light of evidence. Likewise, recent claims by *Leverington* [5, 6] that lavas formed the channels fail to explain key channel features, and overlook the basic fact that volcanic processes are nearly always constructive (infilling or mountain building) rather than erosive. The outflow channels include unique features such as scablands, enormous cataracts (as shown here), longitudinal

ridges on channel floors, and hanging valleys, which are not associated with so-called “channels” on the Moon. Collectively, the geomorphic and other indications that water eroded the outflow channels represent a persuasive body of evidence. Sinuous lunar rilles likely were lava tubes that have mostly collapsed and undergone eons of meteoritic gardening, forming valleys.

Other Cataracts: More examples of cataracts in the outflow channels can be seen in these THEMIS images [4]: V32525002 (Daga Vallis), V18186012 (Ares Vallis), and farther upstream in Kasei Valles, V03248007 and V13982009.

Recommendation: The IAU should consider formal nomenclature for Martian cataracts.

References: [1] Davatzes, A. et al. (2007) *7th Intl. Conf. on Mars*, Abst. 3202. [2] Coleman, N. (2010) *LPSC XXXXI*, <http://www.lpi.usra.edu/meetings/lpsc2010/pdf/1174.pdf>. [3] US Geological Survey (2012) http://planetarynames.wr.usgs.gov/images/mc10_mola.pdf. [4] Christensen et al., *THEMIS public releases*, <http://THEMIS-data.asu.edu/>. [5] Leverington, D. (2004) *JGR* doi:10.1029/2004JE002311. [6] Leverington, D. (2009) *JGR*, doi:10.1029/2009JE003398.

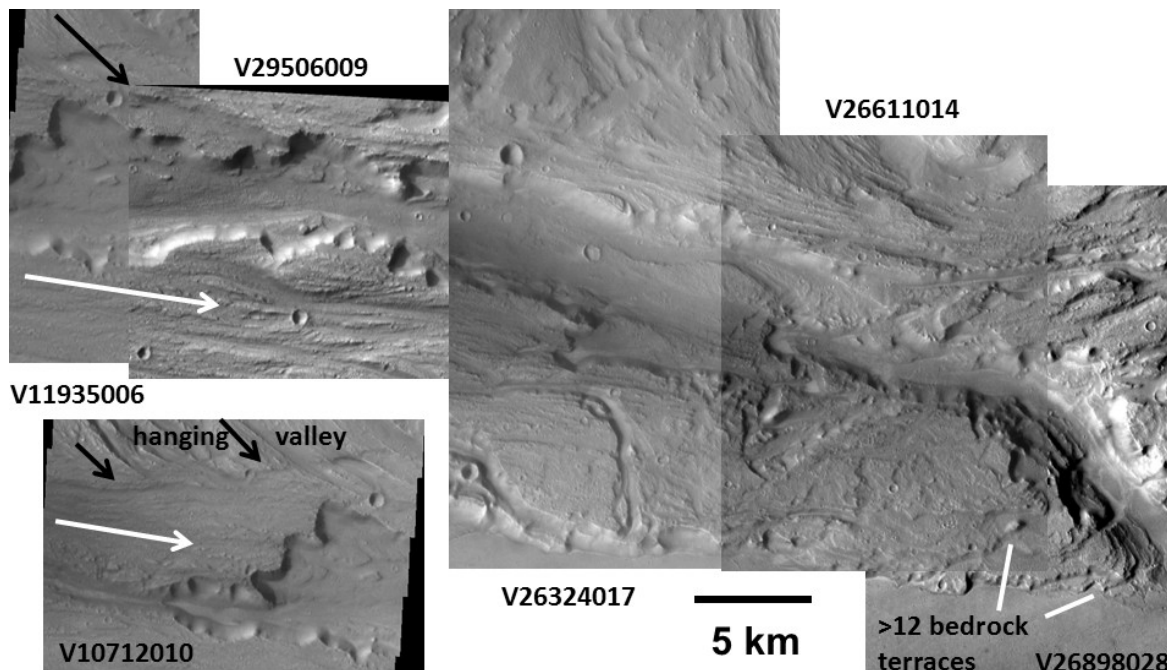


Fig 4. THEMIS visible light images [4] of cataract complex “C.” White arrows show direction of floodwaters that eroded cataract. Black arrows show flow direction in older channel, crosscut by cataract-forming flows. Cataract inception began at lower right, migrating upstream 50 km to the west. Inset (lower left) shows westernmost upstream part of cataract complex.