References

Johnston SA, Montesi LG (2012) The role of dike intrusions in ridge formation on Europa 43rd Lunar Planet Sci Conf, abstract #2538, Houston

Sinkhole

- Dune Crestline Pit
- Karst

Definition

Elongate, positive-relief landforms that have a planform with multiple curves.

Morphometry

Sinuous ridges vary in their length, width, height, cross-sectional shape, degree of sinuosity, and other detailed characteristics depending on the formation mechanism. They can be up to several kilometers wide, hundreds of meters in height,

Sinuous Ridge, Fig. 1 Ridges of the Dorsa Argenta, Mars near 76°S 318°E (e.g., Kress et al. 2010). CTX: P13_0006282_1046_XN_75S043W. Scale bar 5 km (NASA/JPL/MSSS)
Sinuous Ridge, Fig. 2  (a) In this example in Medusae Fossae Formation (Mars), sinuous ridges are interpreted as inverted channels from a glacial drainage system (Nüßbaumer 2007). Kite (2012) describes this feature as a typical shallow moat-ridge-fan assemblage, in which rough-topped channels drain through breaks in ridges into fans. Headwater networks are interpreted as eskers (non-inverted) or supraglacial channels (top), ridges as moraines, and inverted channels in the fan as proglacial channels (bottom). An alternative interpretation by Lefort et al. (2012) considers this network of sinuous ridges as a non-glacial fan (a, lower left) and inverted feeder channels (a, upper right) that have undergone deformation either by compaction of porous material, removal of material at depth (e.g., ground ice sublimation), or tectonic processes. (b) Multilevel sinuous ridge interpreted as inverted channel on top of an inverted floodplain (Burr et al. 2009) CTX B17_016137_1745_XI_05S205W near 5°S, 154°E (NASA/JPL/MSSS)
and hundreds of kilometers in length (e.g., Lucchitta et al. 1986; Parker et al. 1986; Ruff and Greeley 1990; Pain et al. 2007; Burr et al. 2009).

Subtypes

(1) By ridge pattern in plan view: low sinuosity to meandering ridges.

(2) By network pattern: isolated, subparallel, branched (including dendritic, tributary, and/or distributary networks, Fig. 1), random. Some ridges form ridge complexes described as shallow moat–ridge–fan assemblages (Kite 2012) (Fig. 2a).

(3) By ridge morphology: cross-sectional shapes are flat (floodplain with scrollbar topography), rounded, thin, wispy (short, narrow, occurring in groups), and multilevel (comprised of a lower ridge and a thin or wispy upper ridge) (Fig. 2b). A sinuous feature that transitions from a positive ridge to a negative valley is called ▶ serpens (Fig. 3).

Interpretations

Sinuous ridges can have a wide variety of different origins. Types of sinuous ridges on Mars can include:

(1) Inverted stream channels: Ridges formed when differential erosion causes a former channel floor that is protected or has become more resistant to erosion than the surrounding surface (e.g., due to a lag deposit or cementation of sediments) to become exposed (e.g., Pain et al. 2007; Pain and Clarke 2009; Burr et al. 2009, 2010; Lefort et al. 2012) (▶ inverted channel).

(2) Eskers: long winding ridges composed of stratified glacial drift deposited by a supraglacial, englacial, or subglacial stream of flowing water that are exposed on what was previously the subglacial floor when the ice retreats (e.g., Shreve 1985; Kargel and Strom 1992; Benn and Evans 1998;

Additional examples include but are not limited to:

(3) Linear sand dunes (seif dunes) (e.g., Mabbutt and Sullivan 1968; Easterbrook 1999; Parker et al. 1986; Ruff and Greeley 1990).

(4) Wrinkle ridges (e.g., Golombek et al. 1991, 2000; Hiesinger and Head 2002).

(5) Lava flow features (e.g., Theilig 1986; Ruff and Greeley 1990; Burr et al. 2009).

(6) Inverted indurated floodplains (flat-topped ridges) (Burr et al. 2009).

(7) Glacial moraines (e.g., Hiesinger and Head 2002; Kargel 2004).

(8) Exhumed igneous and clastic dikes (e.g., Carr and Evans 1980; Pollard 1987; Ruff and Greeley 1990; Head et al. 2006).

Locations of Examples on Mars

Aeolis Dorsa, previously referred to as Aeolis/Zephyria Plana (Burr et al. 2009, 2010; Lefort et al. 2012) (Fig. 4); Argyre Planitia (Kargel and Strom 1992; Hiesinger and Head 2002; Banks et al. 2009; Coleman 2011 and references within, Bernhardt et al. 2013) (Figs. 5 and 6); Dorsa Argentea Formation (Head and Pratt 2001; Ghatan and Head 2004; Kress et al. 2010 and references therein) (Fig. 1); Cerberus Palus (Burr et al. 2009).
IAU Descriptor Term

- **Dorsum, Dorsa**: sinuous features with both positive- and negative-relief segments:
- **Serpens, Serpentes**

See Also

- **Channel Patterns**
- **Dike (Igneous)**
- **Drainage Patterns**
- **Esker**
- **Inverted Channel**
- **Lava Channel**
- **Lava Flow**
- **Linear Ridge Types (Various Origins)**
- **Meander**
- **Ridge Belt (Venus)**
- **Wrinkle Ridge**

References


Charis Dorsum, (6) Surius Vallis. THEMIS Day IR mosaic. Scale bar is 50 km (NASA/JPL-Caltech/Arizona State University)


Coleman N (2011) Phaenna Dorsum, an esker on Mars: insights from THEMIS and HiRISE images and MOLA data. 42nd Lunar Planet Sci Conf, abstract #1906, Houston


1980

Sinuous Rille

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Definition

Linear, meandering features interpreted to be the remains of channels formed by lava that erupted in effusive, high-volume volcanic events (Hurwitz et al. 2012).

Category

A type of lava channel
A type of rille

Synonyms

Arcuate rille; Large sinuous rille; Serpentine cleft (obsolete)