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Sinkhole

► Dune Crestline Pit
► Karst

Sinuous Ridge

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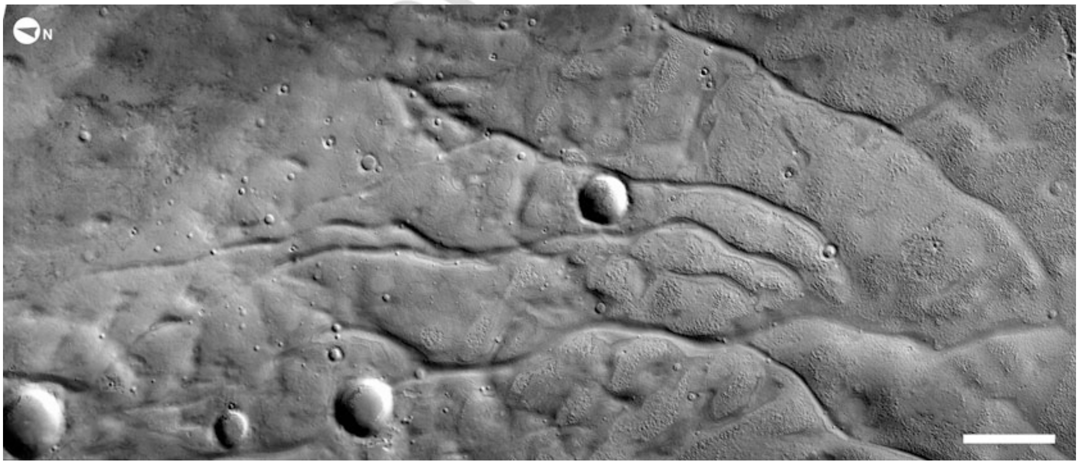
Definition

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 Argentea, Mars near 76°S 318°E (e.g., Kress et al. 2010). CTX: P13_006282_1046_XN_75S043W. Scale bar 5 km (NASA/JPL/MSSS)

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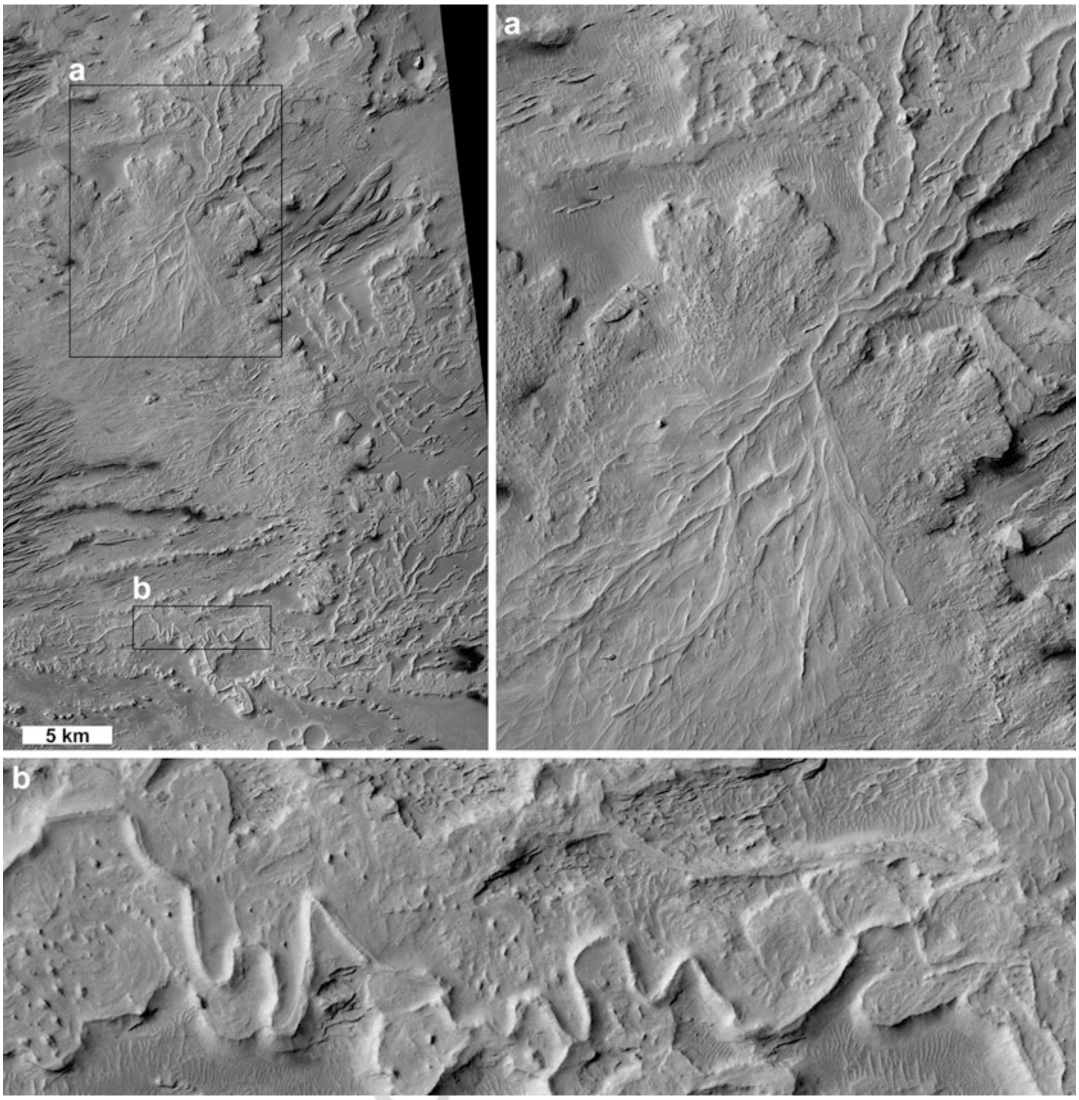


Sinuous Ridge, Fig. 2 (**a**) In this example in Medusae Fossae Formation (Mars), sinuous ridges are interpreted as inverted channels from a glacial drainage system (Nußbaumer 2007). Kite (2012) describes this feature as a typical shallow moat-ridge-fan assemblage, in which rough-topped channels drain 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

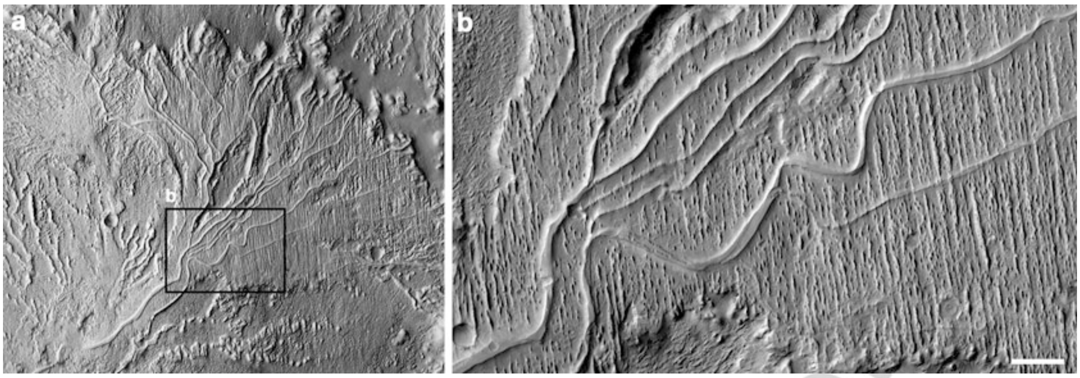
(1) By ridge pattern in plan view: low sinuosity to meandering ridges.
(2) By network pattern: isolated, subparallel, branched (including dendritic, tributary, and/or distributary networks, Fig. 1), random. Some ridges form ridge complexes described as shallow moat–ridge–fan assemblages (Kite 2012) (Fig.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

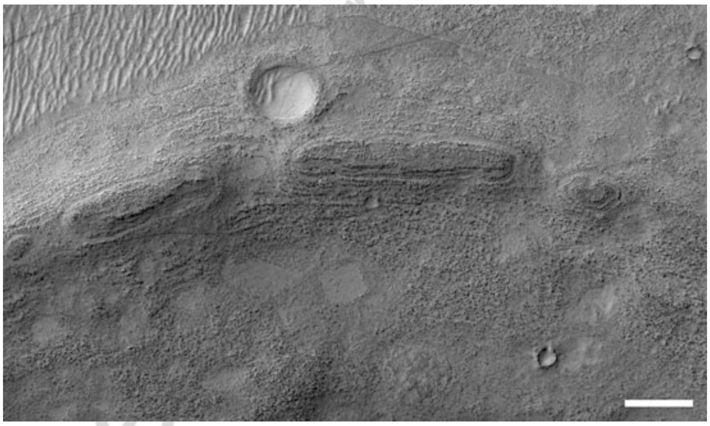
Sinuous ridges can have a wide variety of different origins. Types of sinuous ridges on Mars can include:

(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;

Sinuous Ridge, Fig. 3 In Arabia Terra, Mars (33°N, 46°E), a sinuous feature transitions from a negative-relief valley (*top*) to a positive-relief, low-elevation, rough, and flat-topped plateau (*bottom*) (▶ Serpens) (Williams and Edgett 2005). HiRISE PSP_005355_2125 (NASA/JPL/UA)



Sinuous Ridge, Fig. 4 Sinuous ridges at 6.2°S 151.6°E, Mars, in Aeolis Dorsa (Burr et al. 2009) (▶ Delta). Scale bar 1 km. CTX: B16_015913_1739_XN_06S208W (NASA/JPL/MSSS)



Sinuous Ridge, Fig. 5 Layering in Pasithea Dorsum (Mars) at 54.0°S 317.4°E. Scale bar is 500 m. See Fig. 6 for the location of this sinuous ridge in Argyre Planitia. HiRISE PSP_006875_1255 (NASA/JPL/University of Arizona)

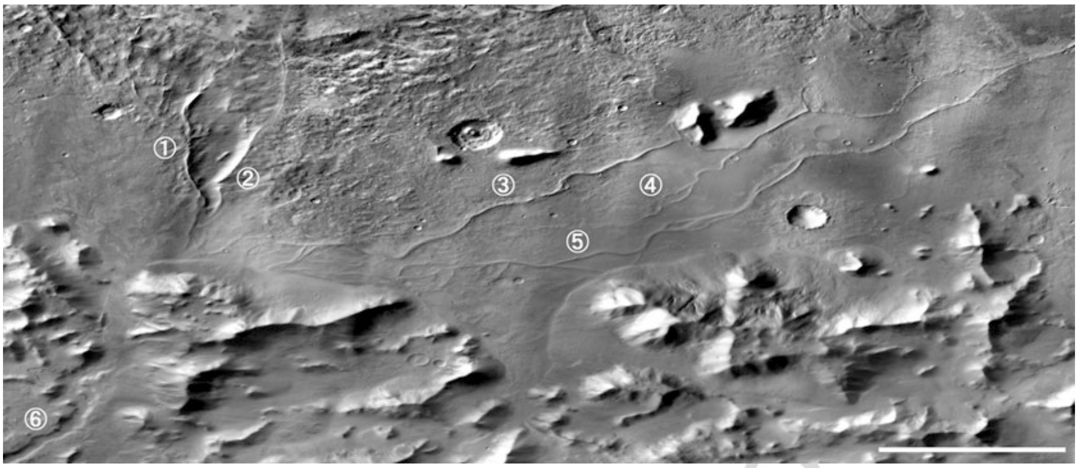
Easterbrook 1999; Brennand 2000; Hiesinger and Head 2002; Banks et al. 2009; Nußbaumer 2007; Kite 2012) (▶ esker).

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).



Sinuous Ridge, Fig. 6 Sinuous ridges in southern Argyre Planitia (Mars). (*1*) Cleia Dorsum, (*2*) Hegemone Dorsum, (*3*) Pasithea Dorsum, (*4*) Auxo Dorsum, (*5*) Charis Dorsum, (*6*) Surius Vallis. THEMIS Day IR mosaic. Scale bar is 50 km (NASA/JPL-Caltech/Arizona State University)

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

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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)