

OBJECTIVES

Qualify and quantify morphological elements of Martian fan-shaped deposits with HRSC-data and categorically classify types of these large fan-shaped deposits.

BACKGROUND

Martian fan-shaped deposits show architectural elements similar to those of terrestrial analogues. Fan morphology is related to upstream and downstream conditions such as water discharge and duration, sediment flux and properties, as well as basin size and water level [1, 2]; and is indicative of climatic conditions at time of deposition [3].

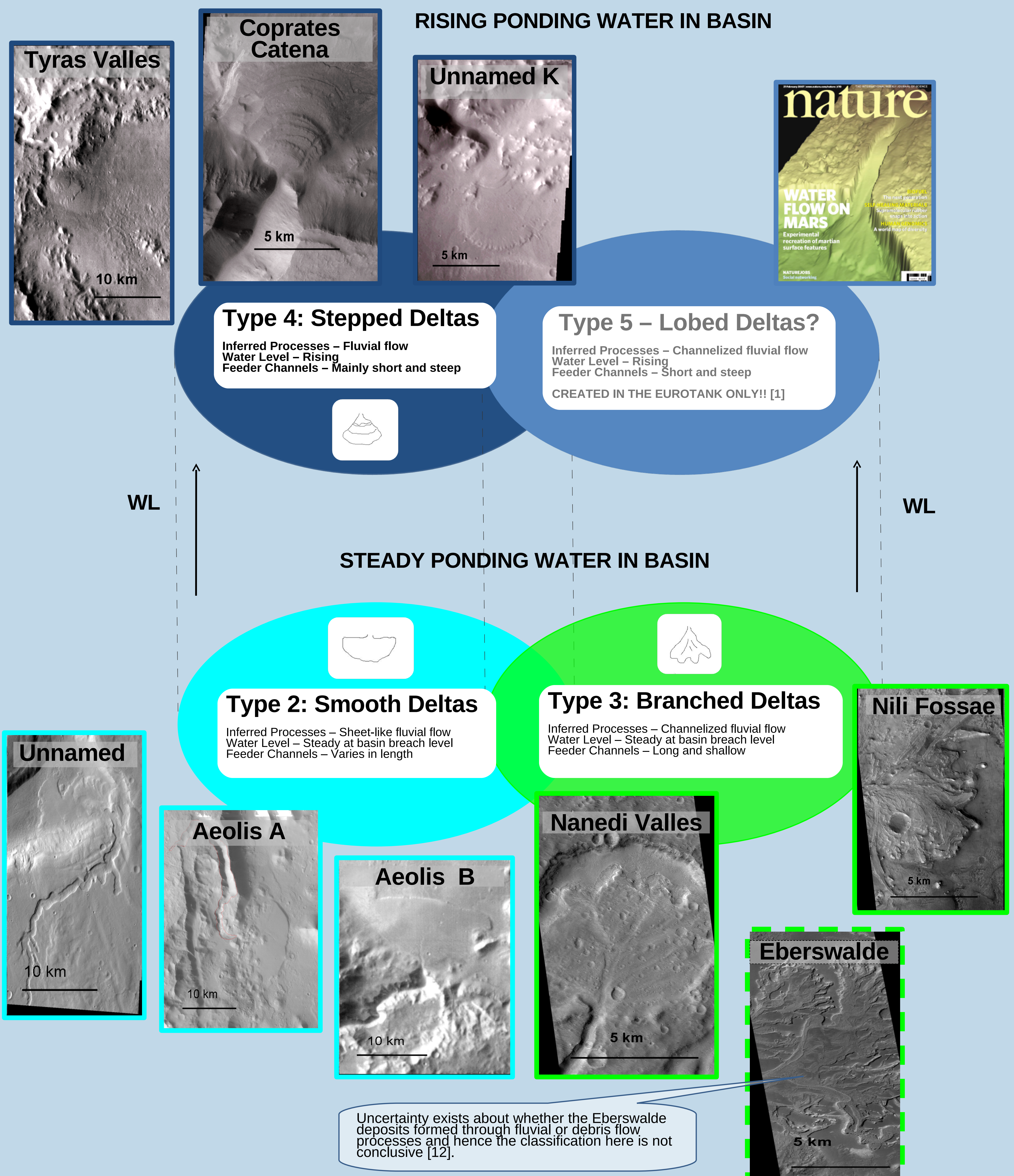
MORPHOLOGICAL PARAMETERS

| | TYPE 1 Alluvial Fans | TYPE 2 Smooth Deltas | TYPE 3 Branched Deltas | TYPE 4 Stepped Deltas |
|-------------------|-------------------------|----------------------------|------------------------------|-----------------------------|
| Approximate Shape | Classic cone-shape | Smooth semi-circular | Branched fan-shape | Stacked terraces |
| Average Gradient | ~ 3 degrees | ~ 1 degree | ~ 1 degree | Varies |
| Average Length | ~ 20 km | ~10 km | ~ 5 km | ~10 km |

TYPES OF DEPOSITS

Lengths, gradients and shapes of roughly 30 deposits from 20 sites were measured and described:

- **Type 1 Alluvial Fans:** Large, relatively low-gradient, fluvially dominated fans with classic conical shapes with short and steep or absent feeder channels [e.g. 4]
- **Type 2 Smooth Deltas:** Semi-circular, flat-topped, Gilbert-type deltas with steep fronts indicating sheet-flow conditions and with long feeder channels suggesting bed-load dominated transport [e.g. 5]
- **Type 3 Branched Deltas:** Bird-foot shaped, branched deltas indicating channelized-flow conditions and with medium to long feeder channels [e.g. 6, 7, 8]
- **Type 4 Stepped Deltas:** Terraced deltas with clear fronts and frayed toe-sets, as well as short feeder channels [e.g. 9, 10, 11]



SUMMARY

- Two important parameters, *water level* and *degree of branching*, can be used to distinguish between different types of deposits
- Alluvial fans form into dry basins, whereas deltas form into basins with ponding water and steady or rising water levels
- Deltas can be dominated by sheet-flow or channelized flow
- Relationships exist between the different "end-member" types of deltas and overlap between types do occur (see Venn-diagrams)
- Different morphological types of fan-shaped deposits indicate different types of processes and possibly different types of climatic conditions at formation [13]

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