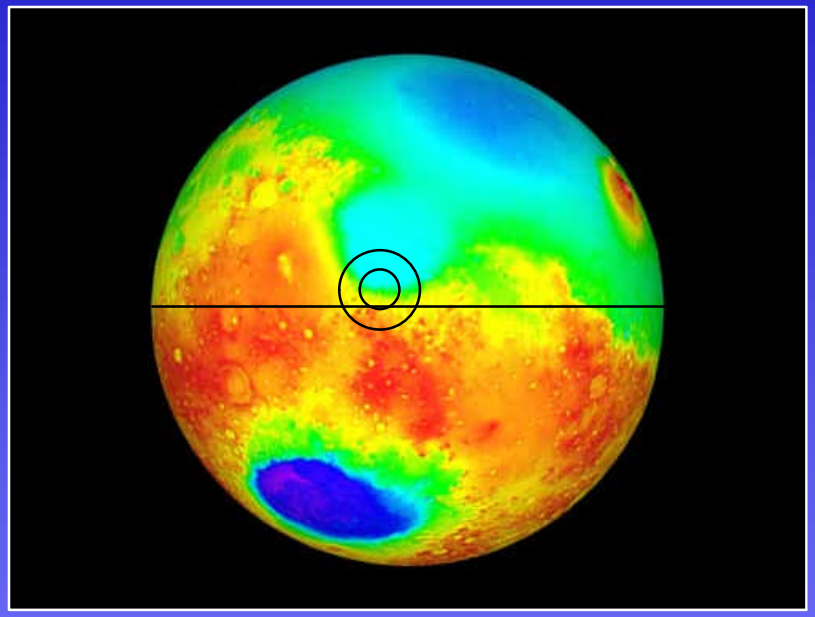
Isidis Candidate Landing Site



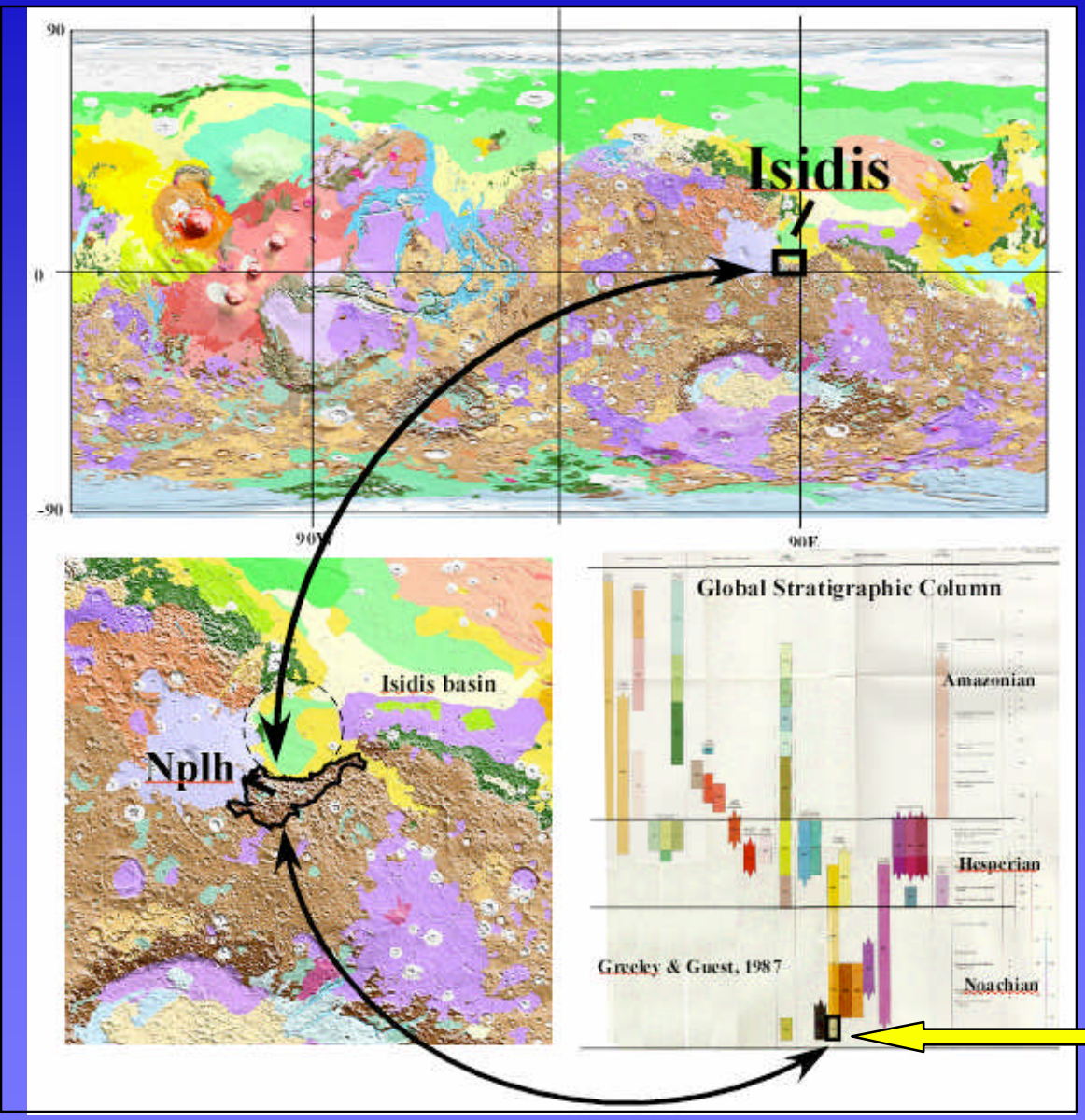
Larry Crumpler

Ken Tanaka

Presentation Outline

1. **Brief Review of Regional Geology**
2. **Discussion of Target Characteristics**
3. **Discussion of Observables at Target**
4. **Discussion of Hypotheses Testable at Target**
5. **SWAT**

ISIDIS: MOST ANCIENT SURFACE

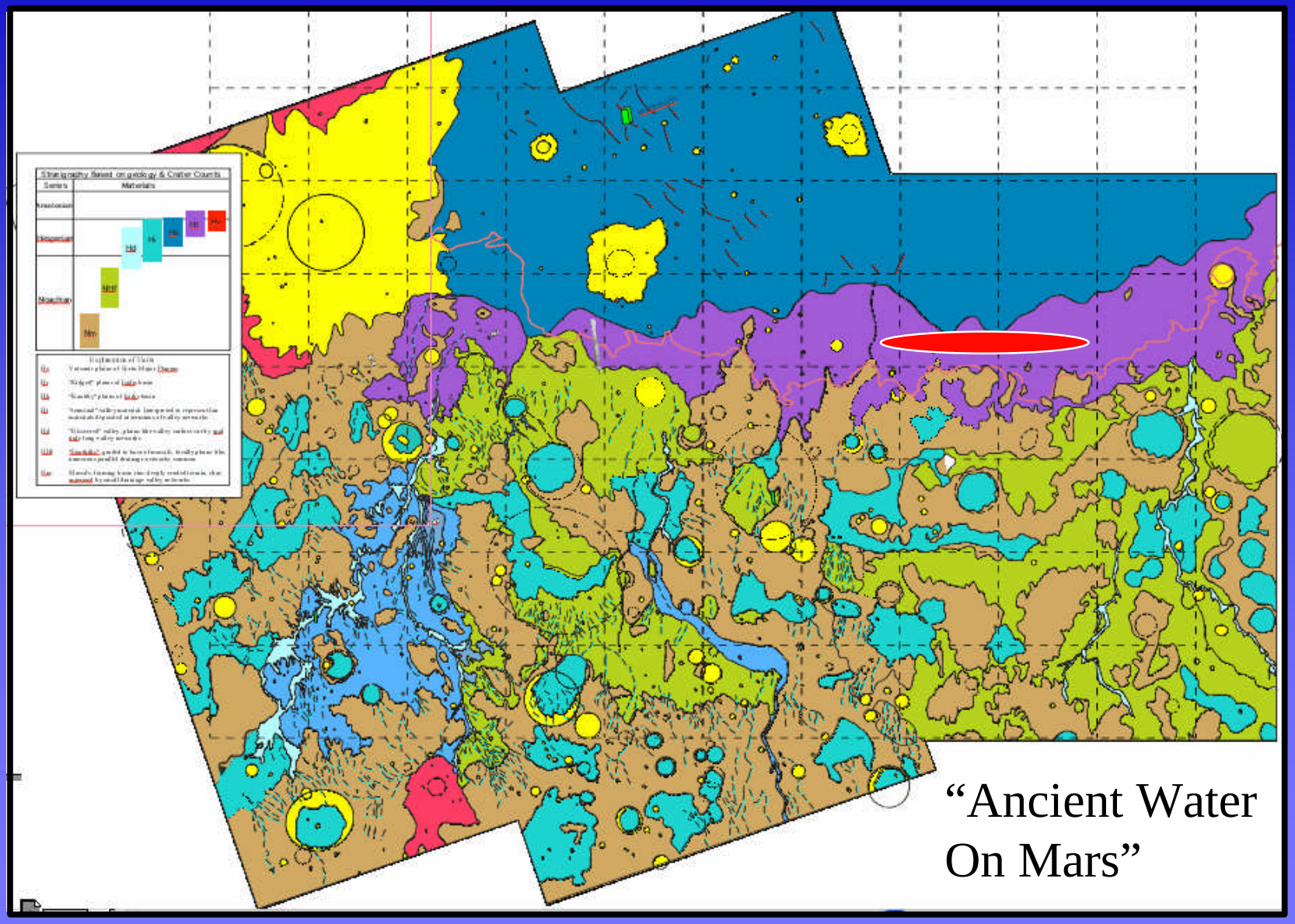


Libya Montes, Isidis Rim:

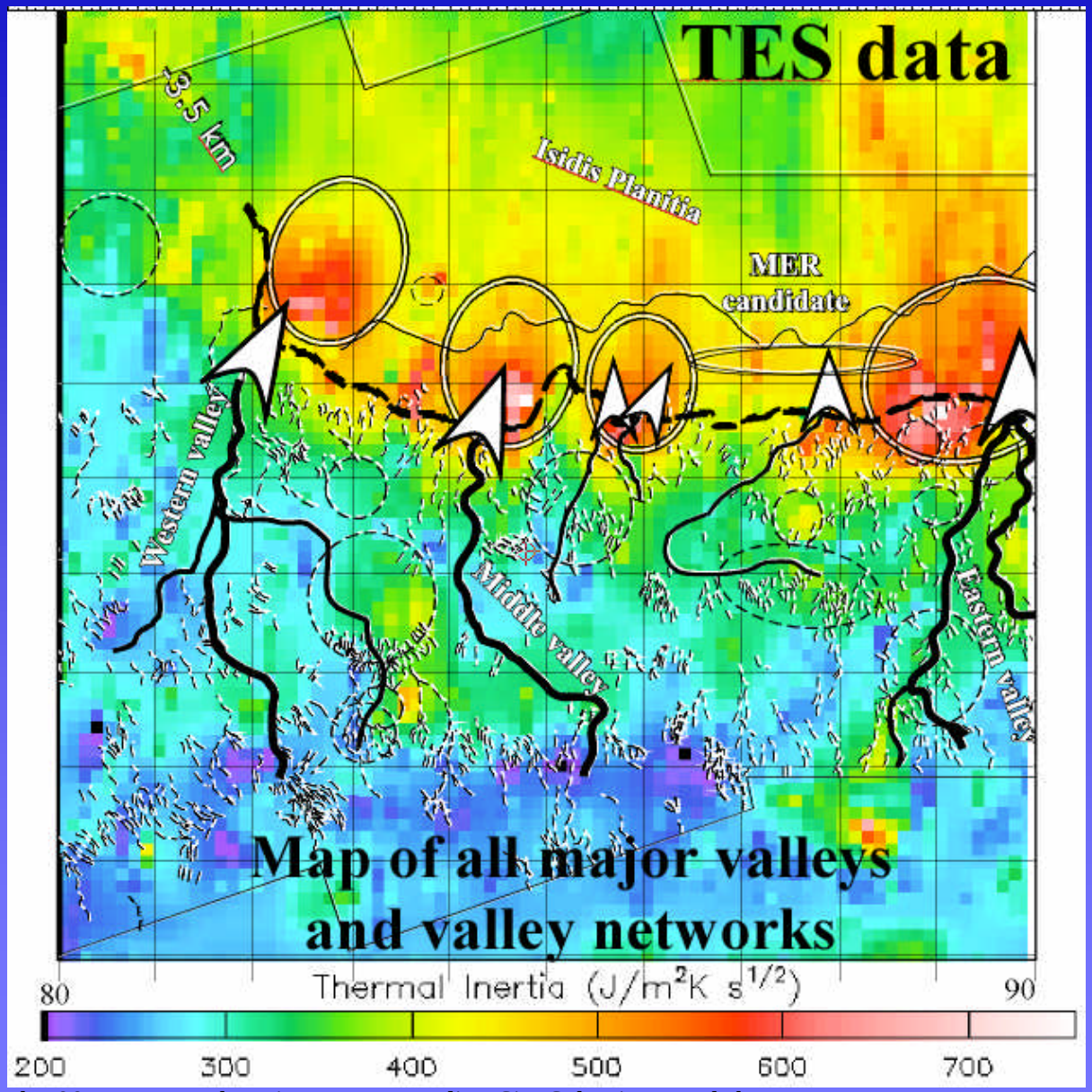
- **oldest Geologic Unit on Mars**
- **witness to entire Martian geologic history**
- **tells us about the earliest, wettest climate**

bottom of section

ISIDIS: GEOLOGIC MAPPING



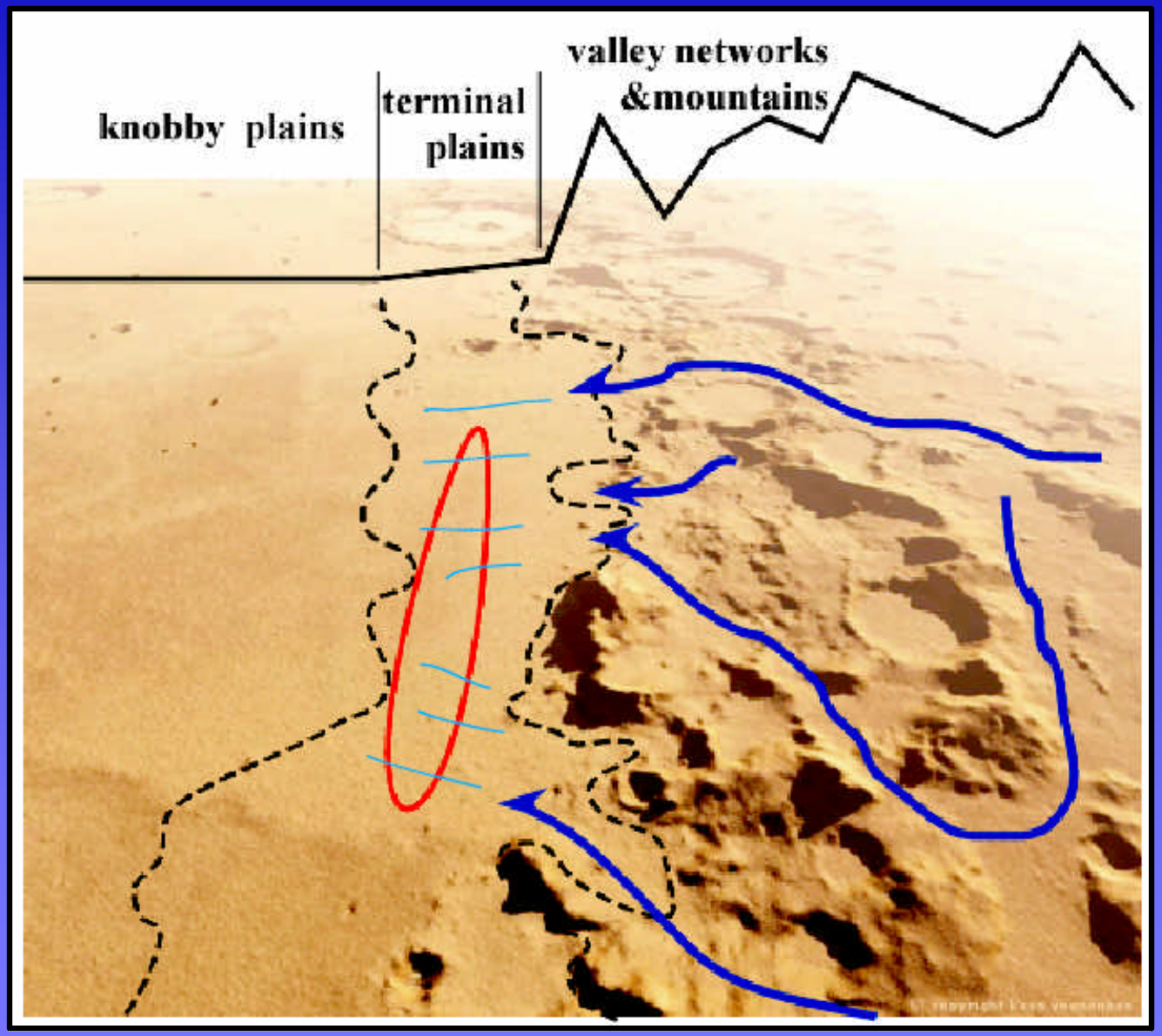
ISIDIS: Sedimentation



- **High valley network density**

- **High TI**
  -along rim slopes
  -at termini of major valleys

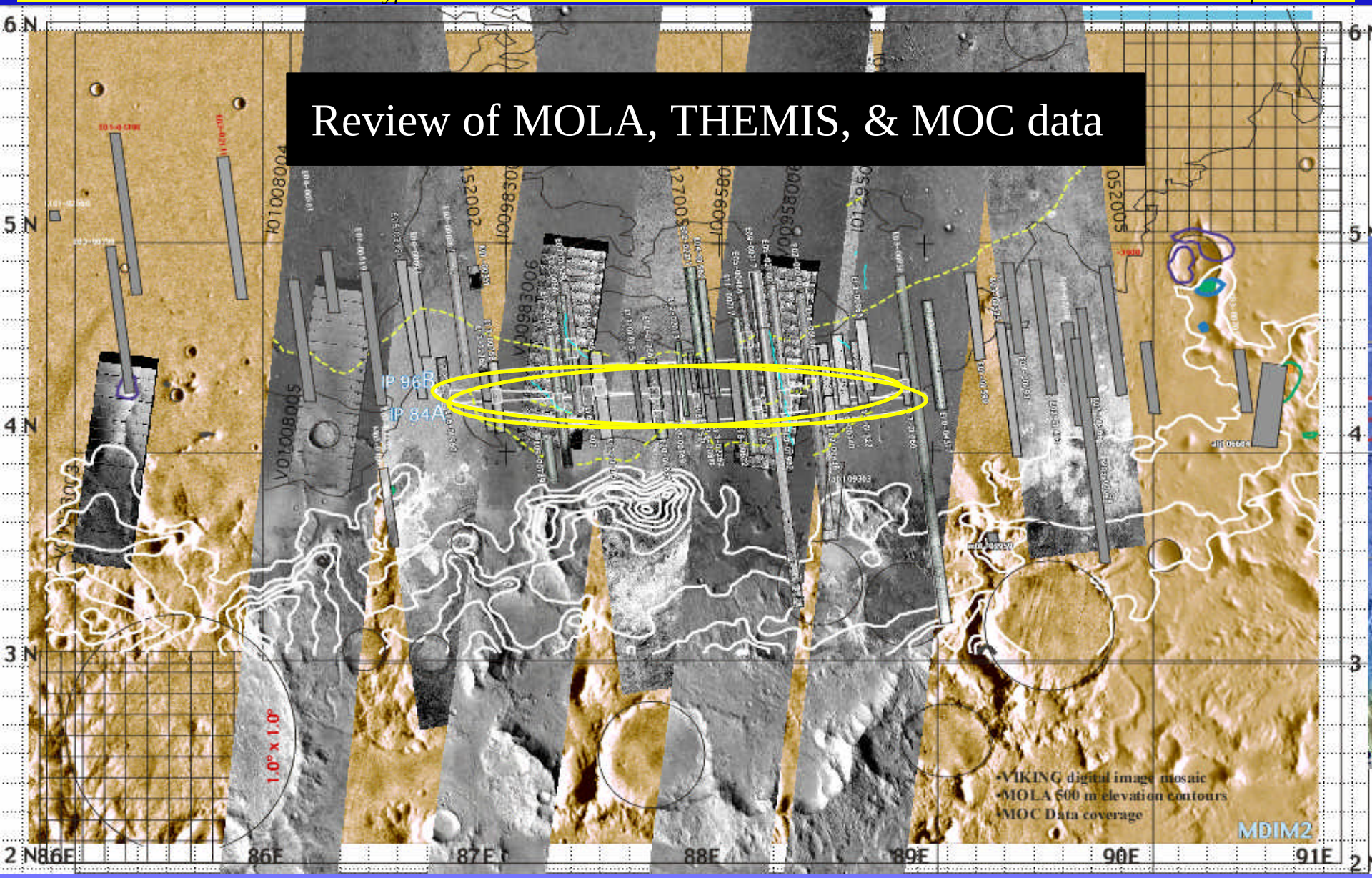
ISIDIS: Target Hypothesis



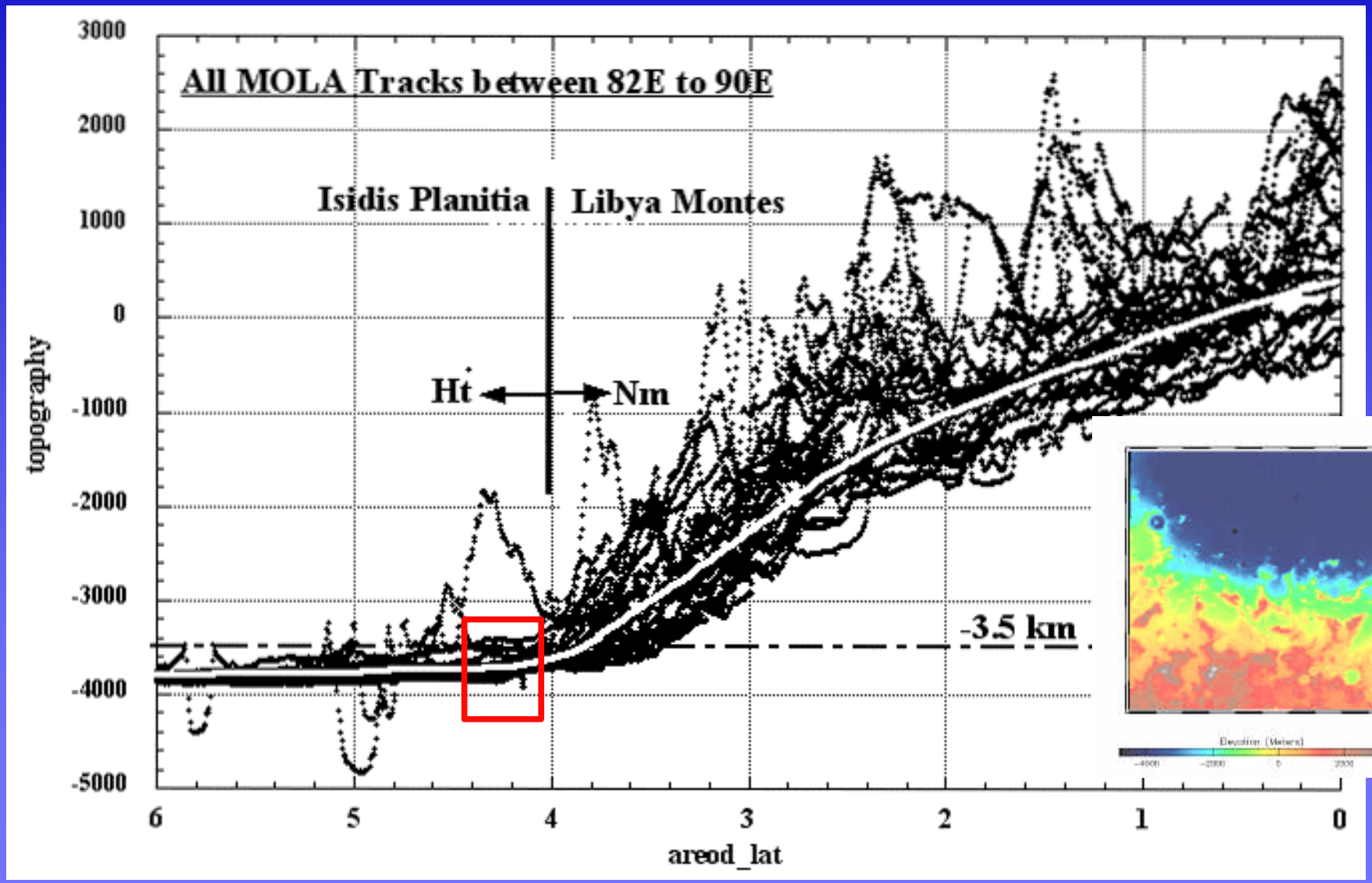
ISIDIS: Region Significance

- **Ancient water**
  - **low energy fluvial, not catastrophic**
  - **earliest through mid-late geologic history**
- **Sediments**
  - **of rocks and fines , not just fine clay or dust**
  - **detritus from fluvial & mass wasting**
- **Climate record**
  - **mineral & chemical signature of water recorded in modified rocks**
  - **potential influences from two distinct climatic epochs**

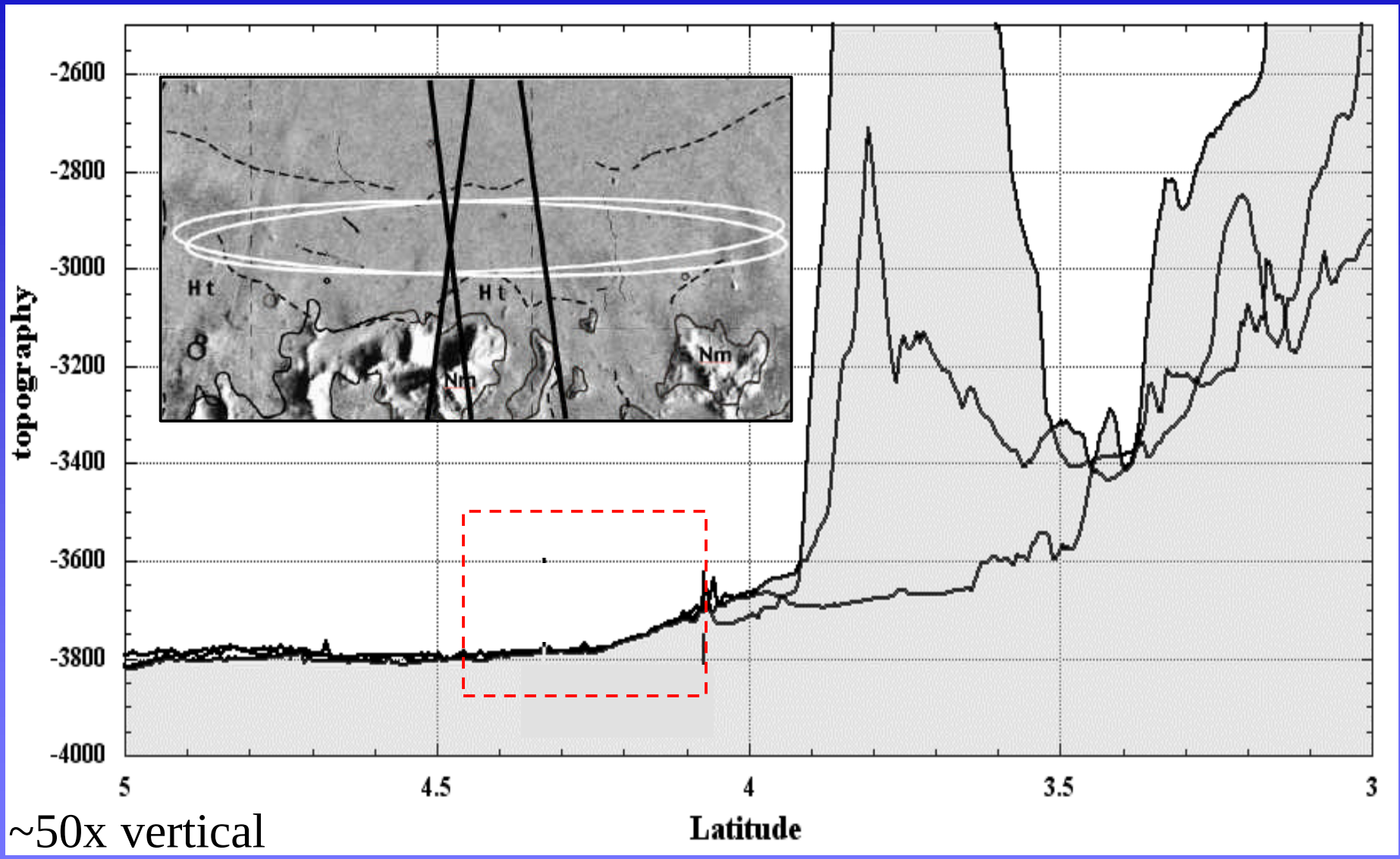
ISIDIS: Target Ellipse



ISIDIS: Target MOLA Data

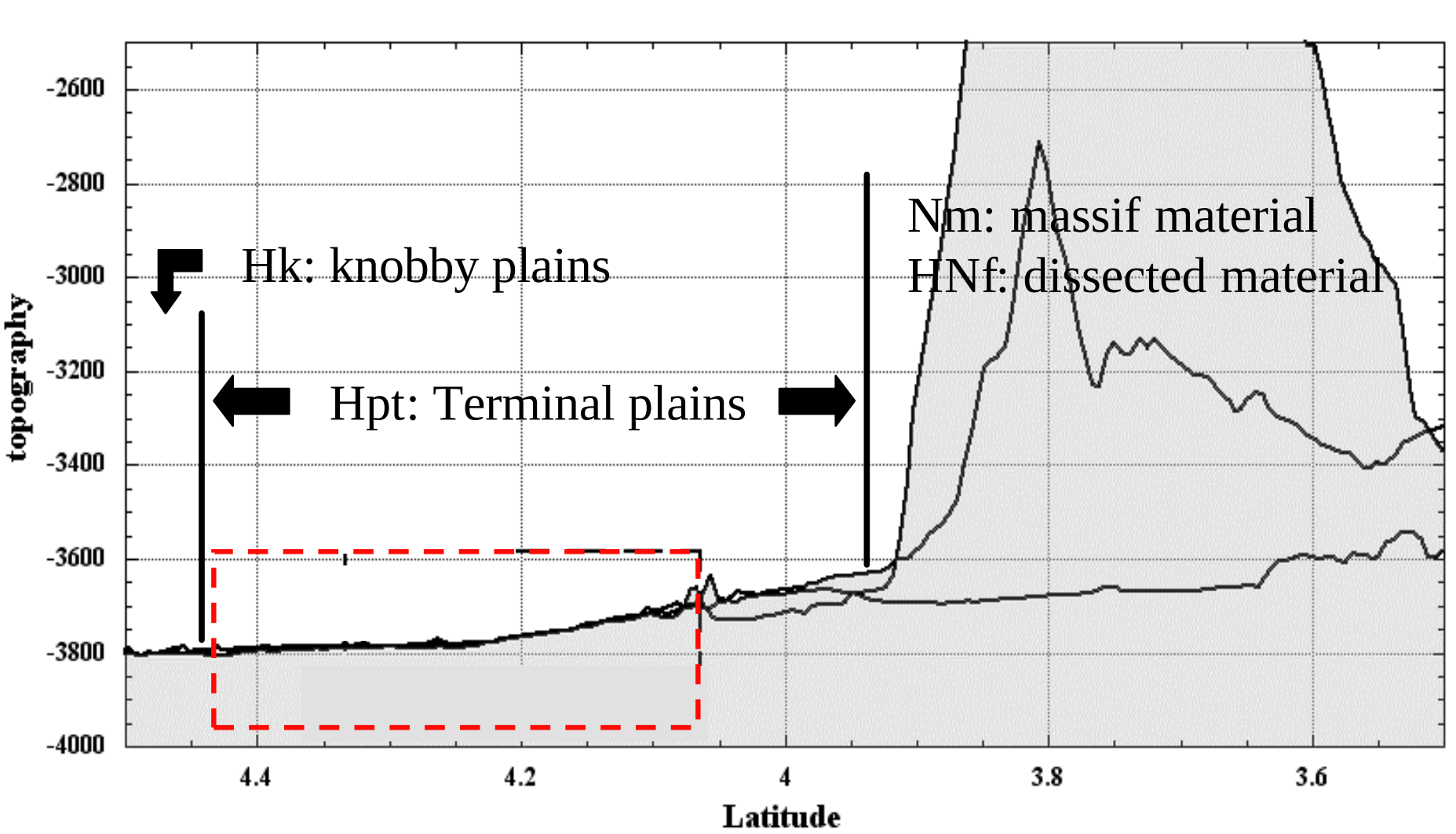


ISIDIS: Target MOLA Data

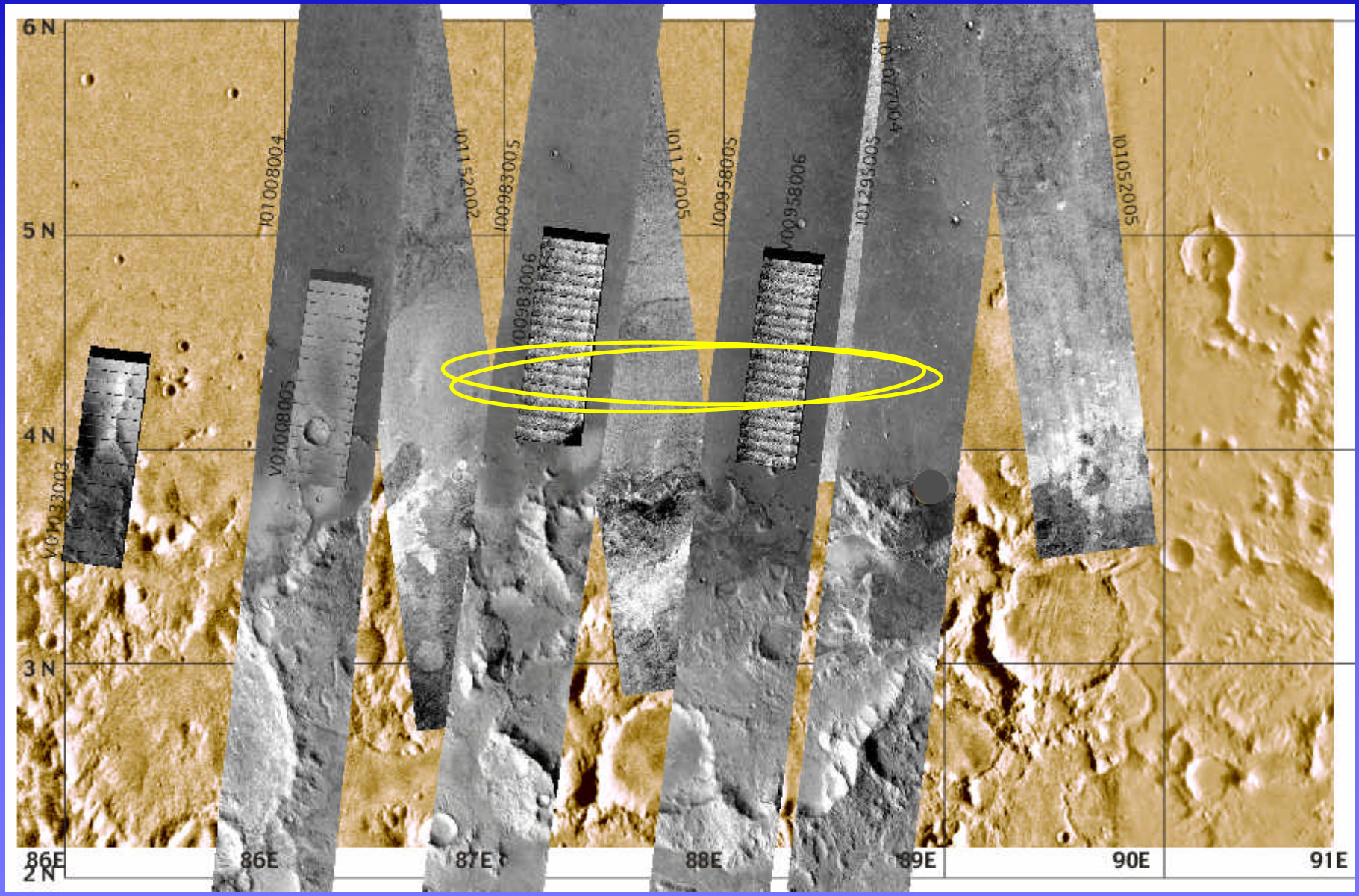


~50x vertical

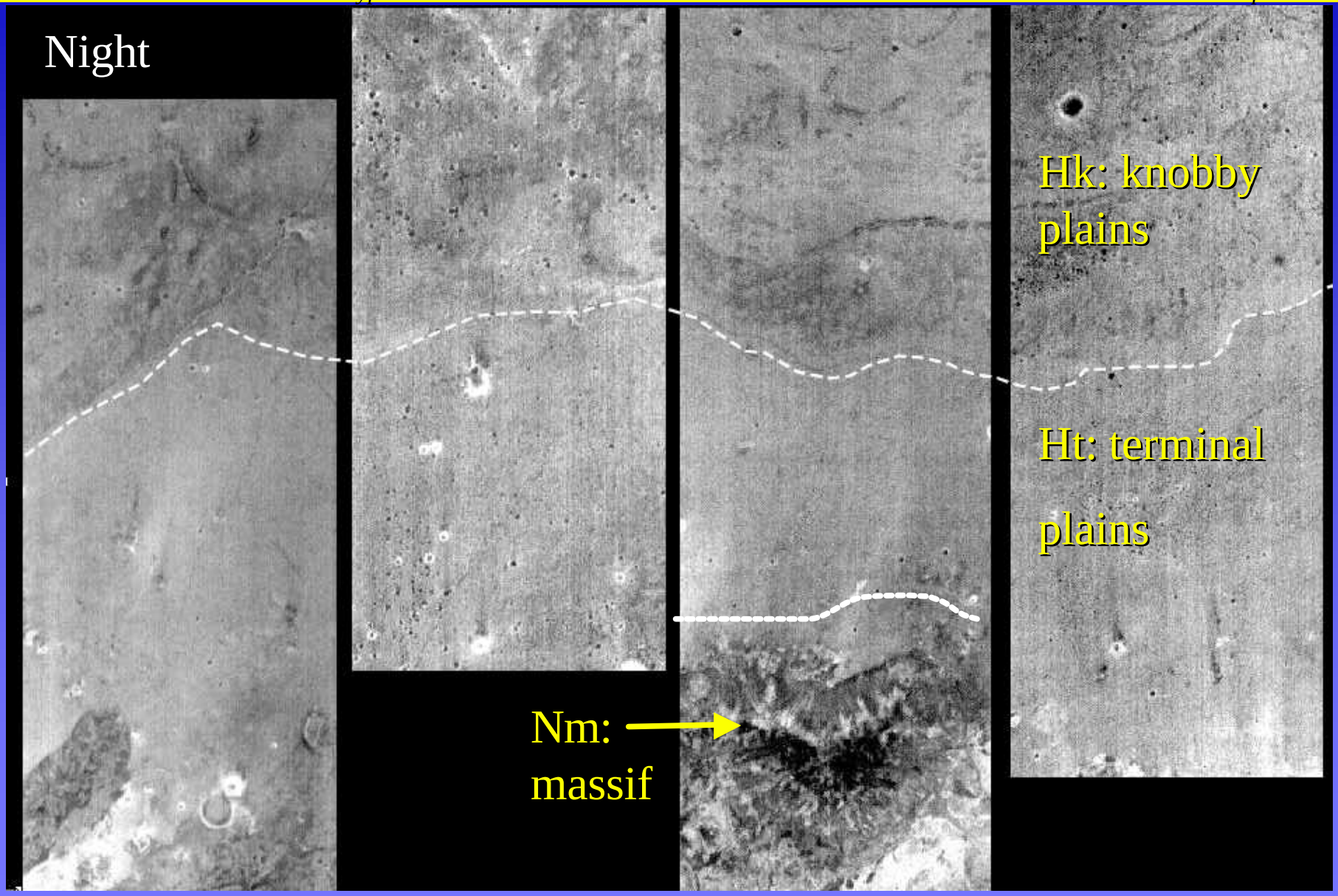
ISIDIS: Target MOLA Data



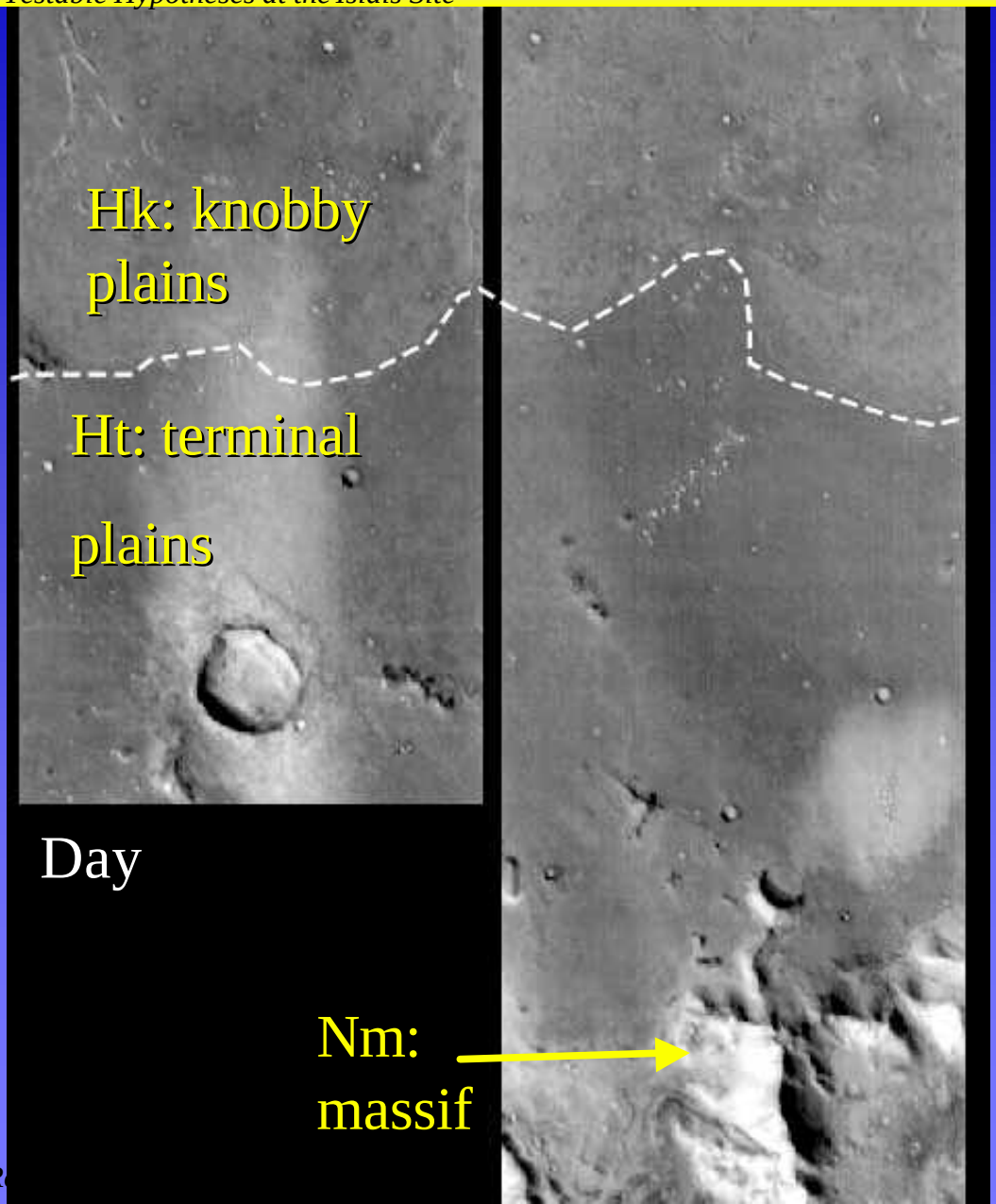
ISIDIS: Target THEMIS Data



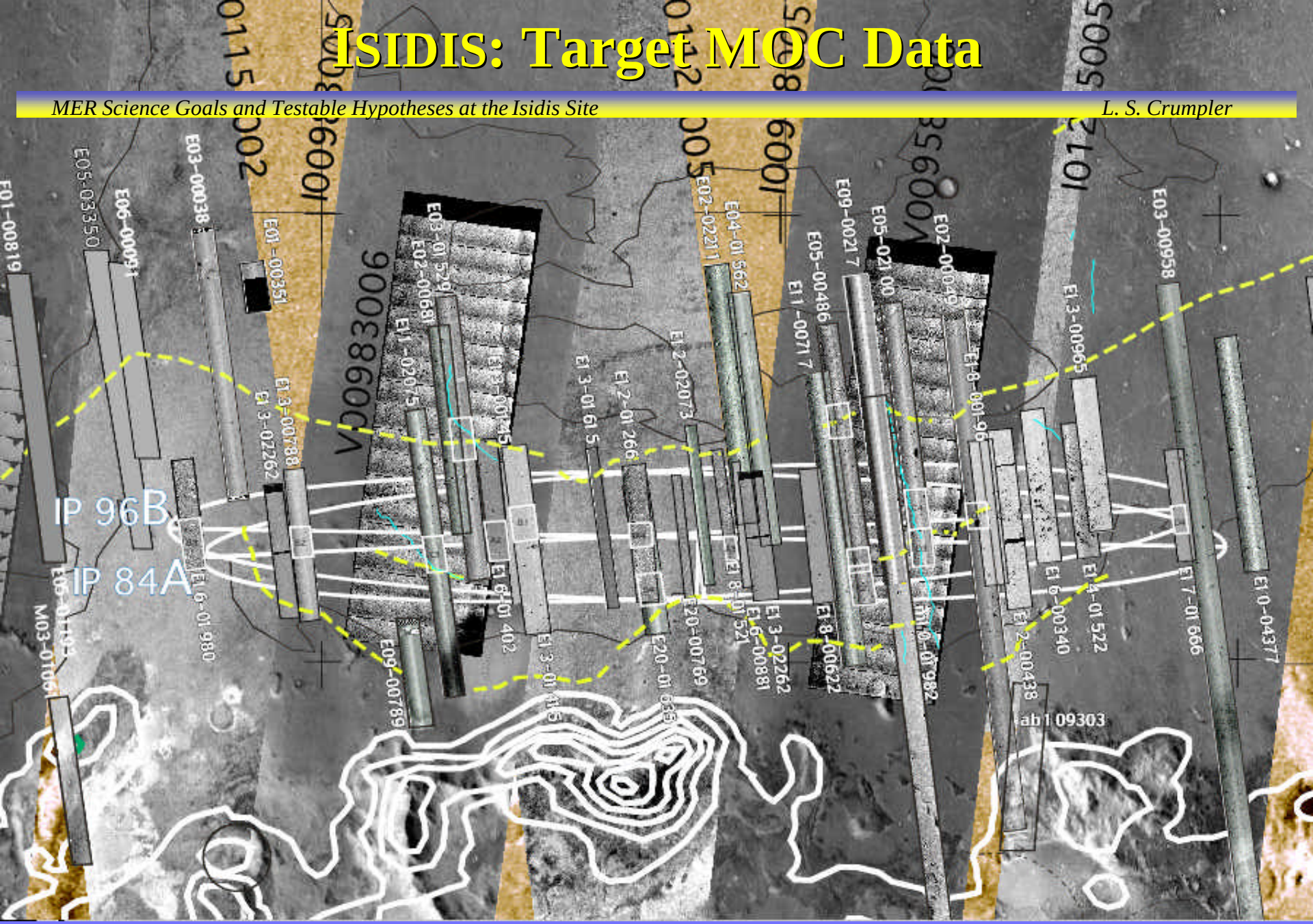
ISIDIS: Target THEMIS Data



ISIDIS: Target THEMIS Data

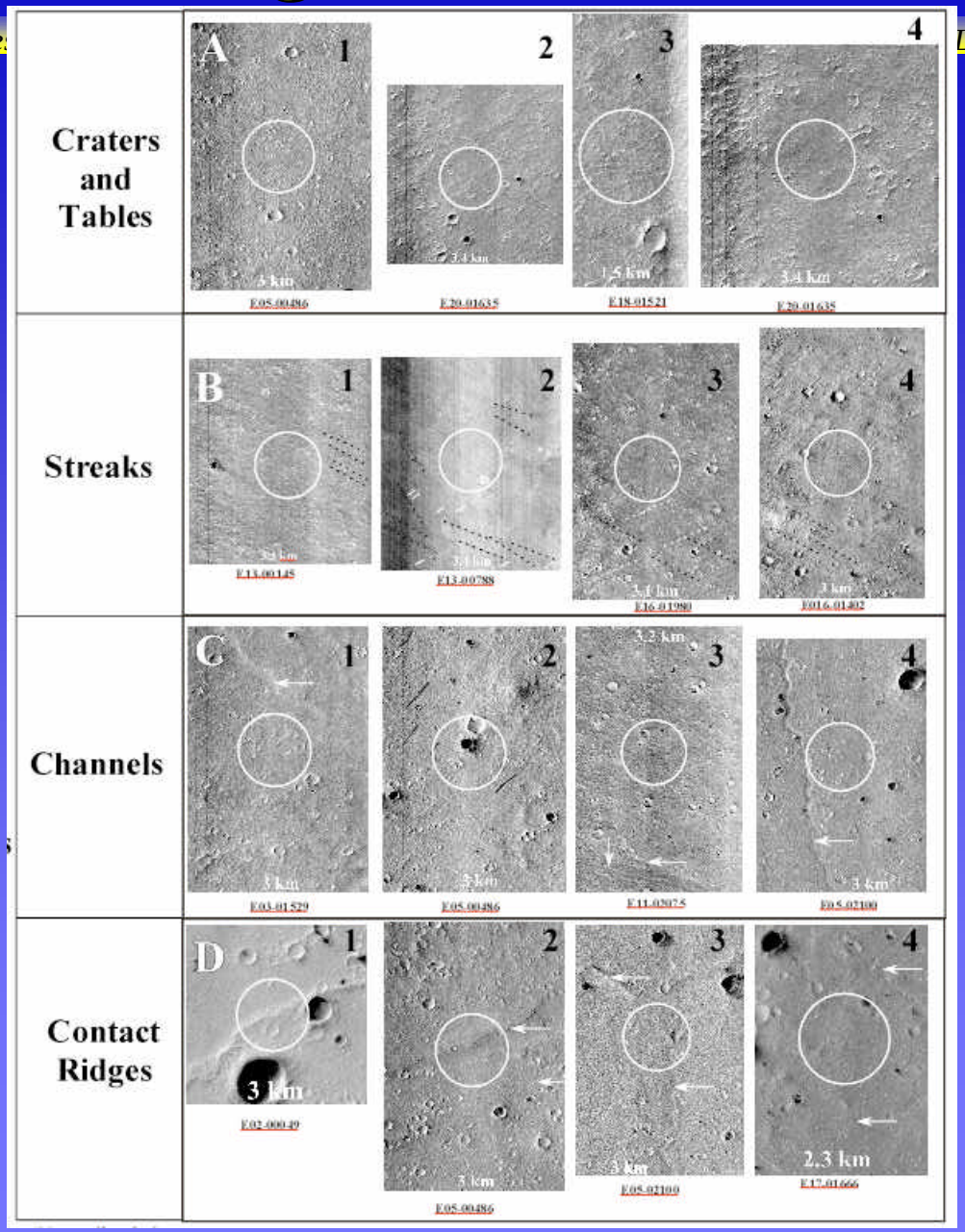


ISIDIS: Target MOC Data

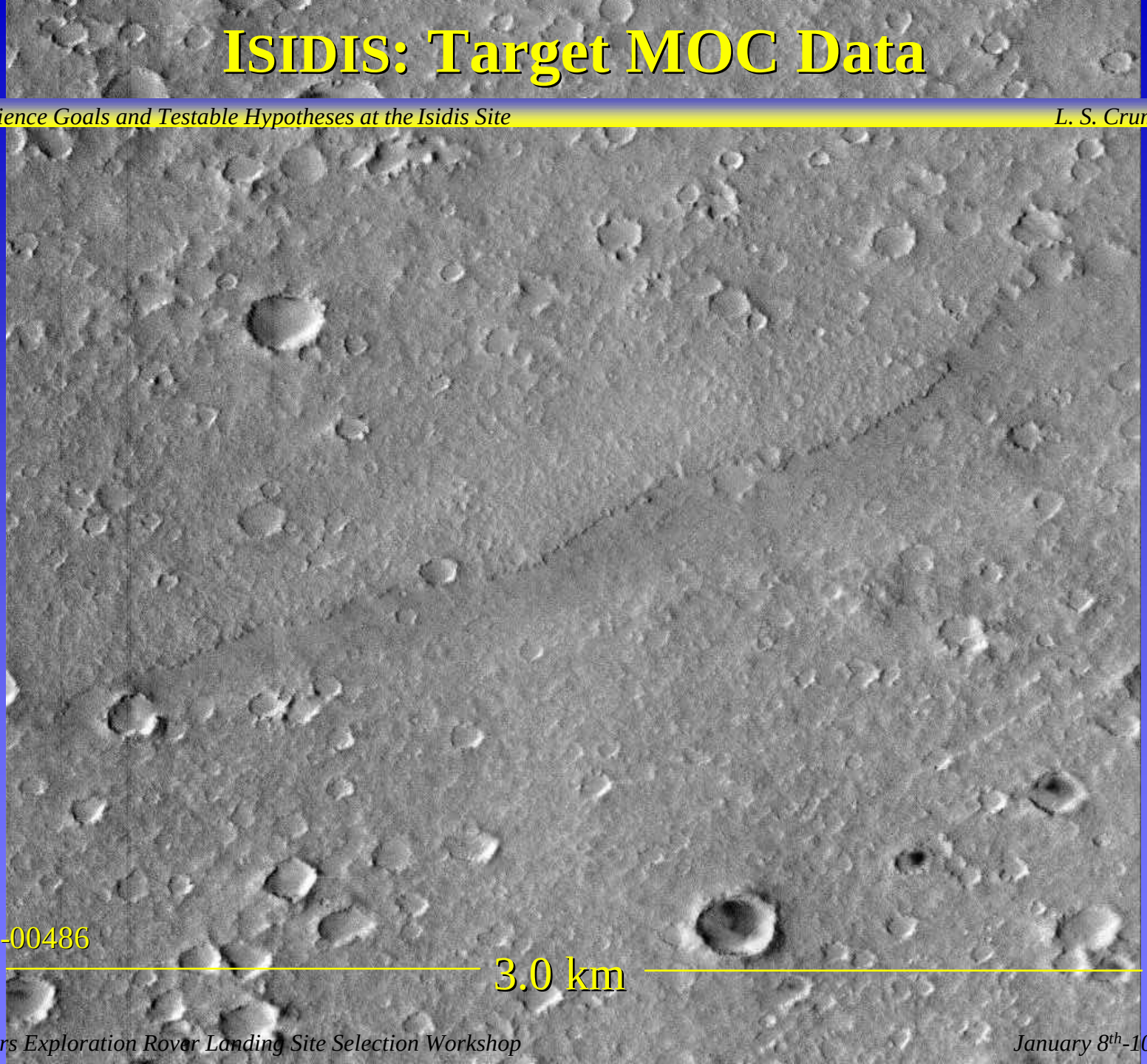


ISIDIS: Target MOC Data

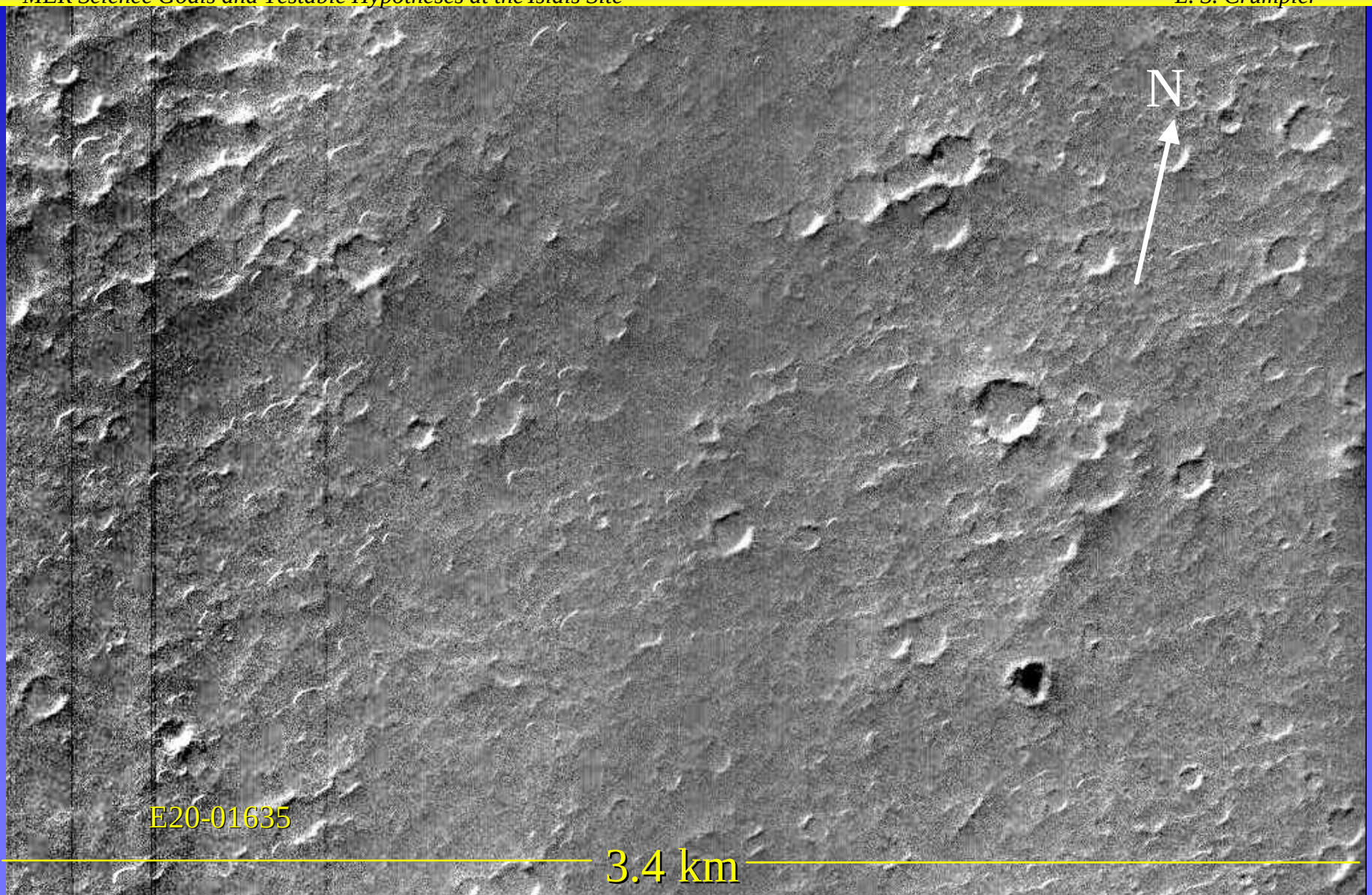
- Four types of Surface within Target ellipse



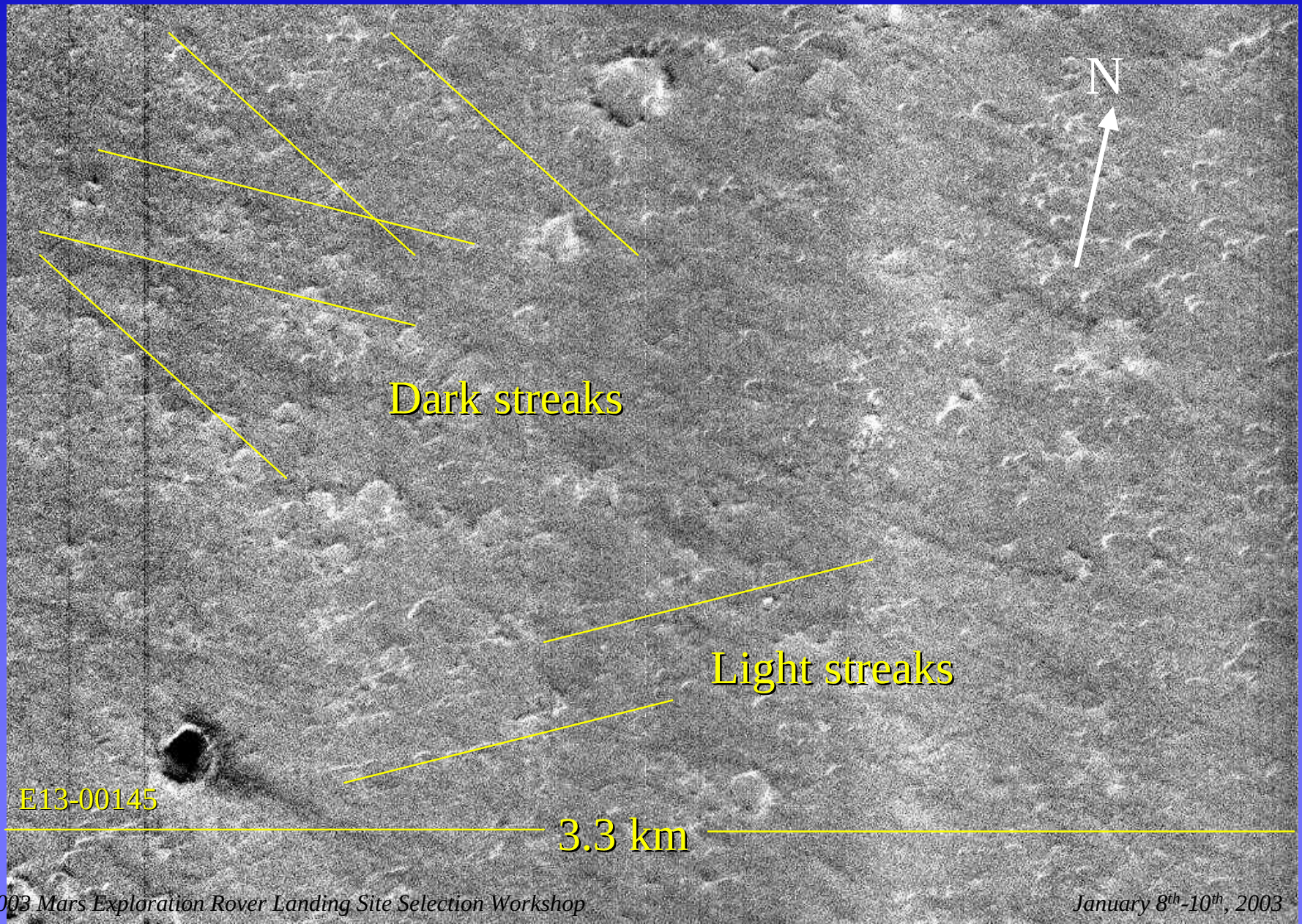
ISIDIS: Target MOC Data



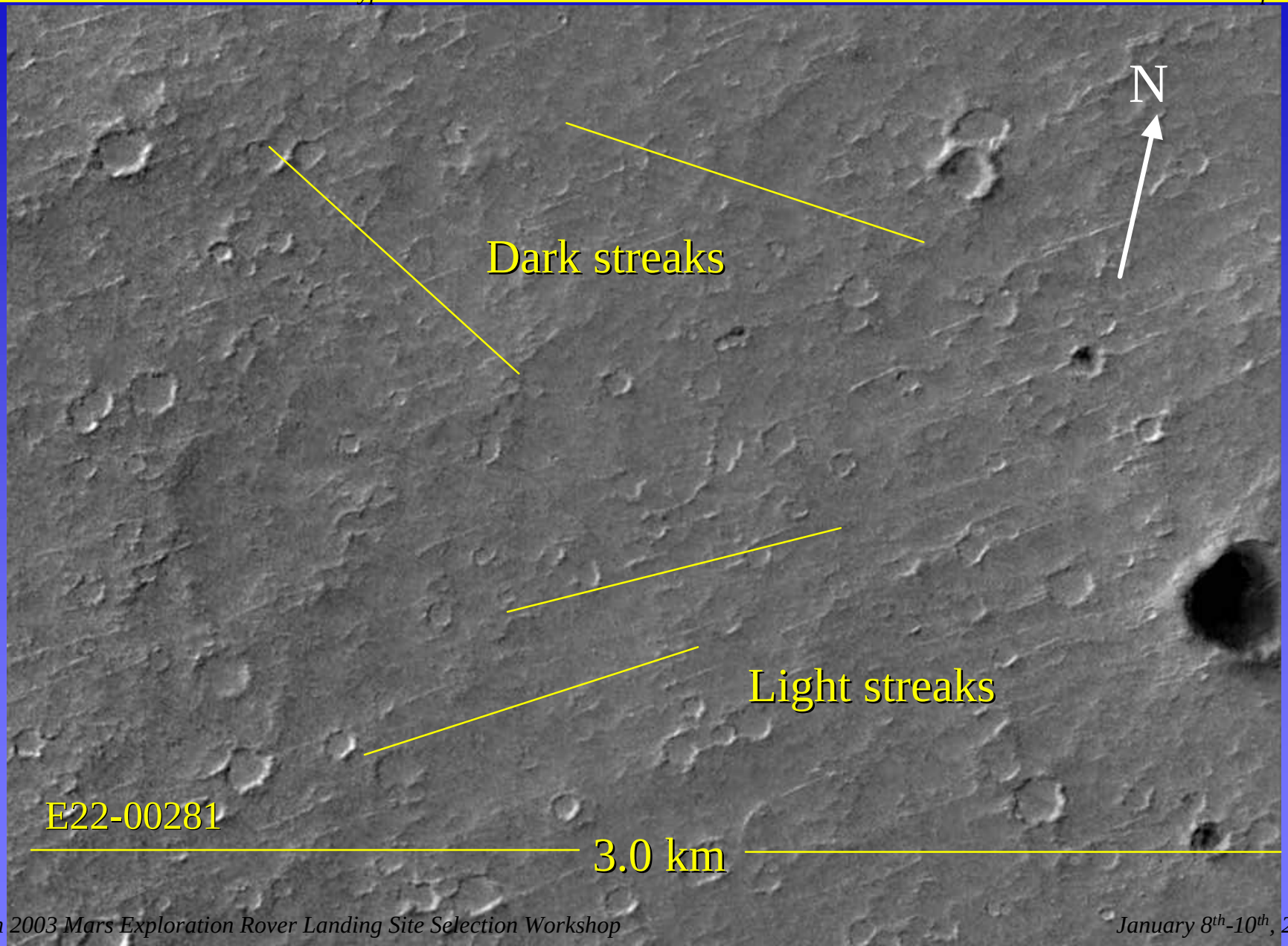
ISIDIS: Target MOC Data



ISIDIS: Target MOC Data



ISIDIS: Target MOC Data



ISIDIS: Target MOC Data

Summary of Wind Indicators

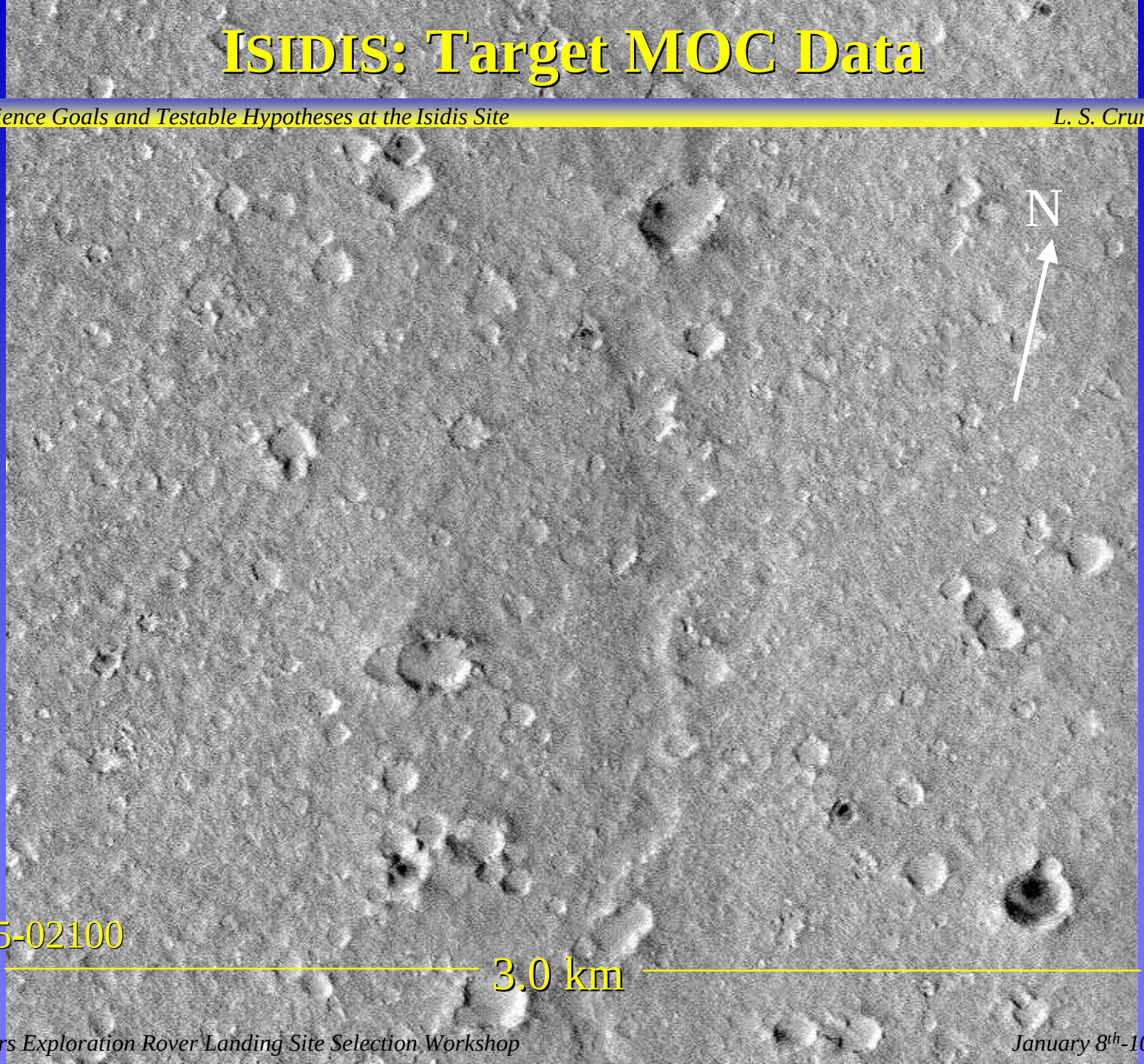
-bright/dark streak

-bright streak are close to agreement with mesoscale wind models

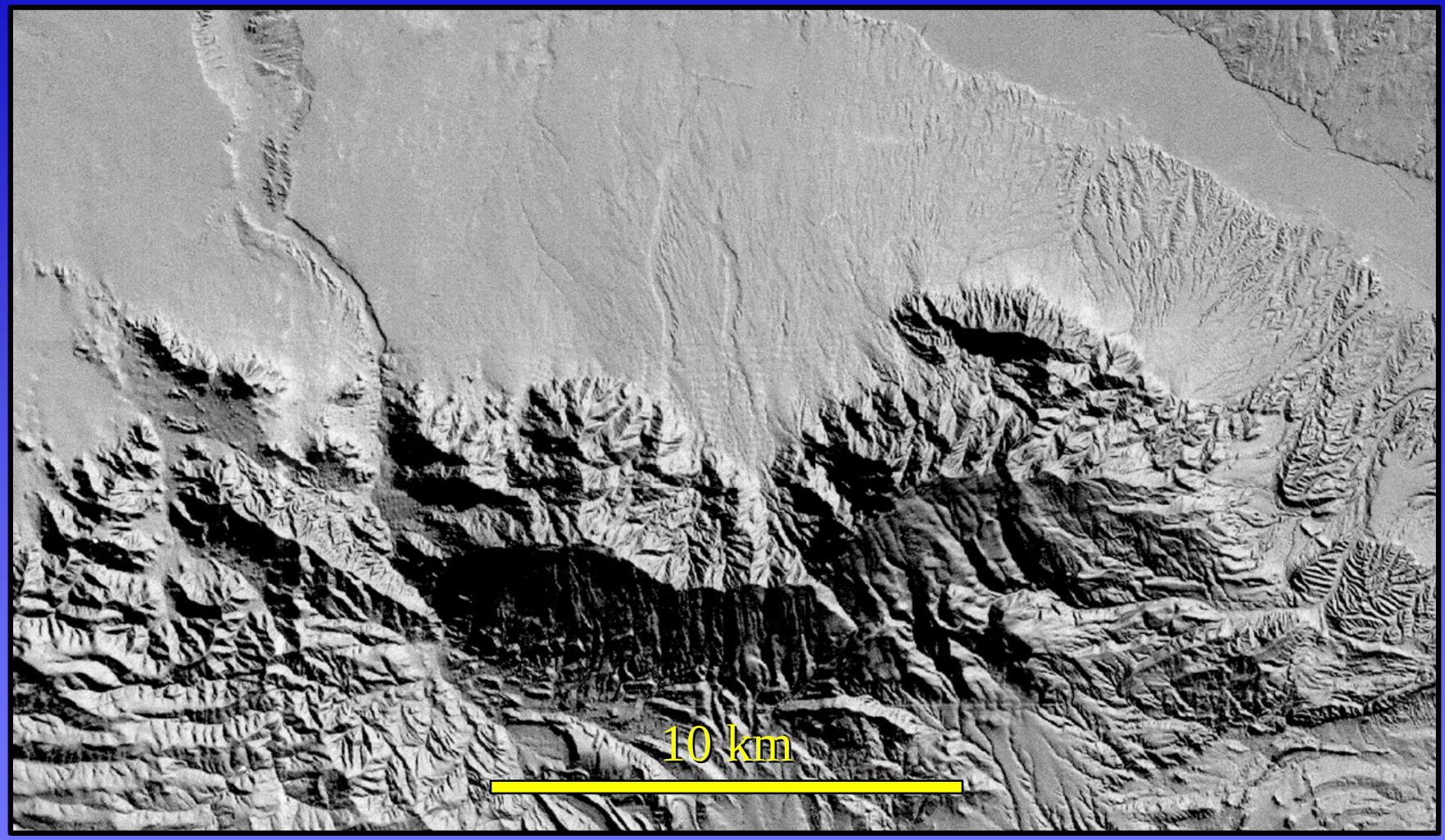
-the most prominent (dark streaks) are 90° to model

-bright streaks are not oriented down slope

ISIDIS: Target MOC Data

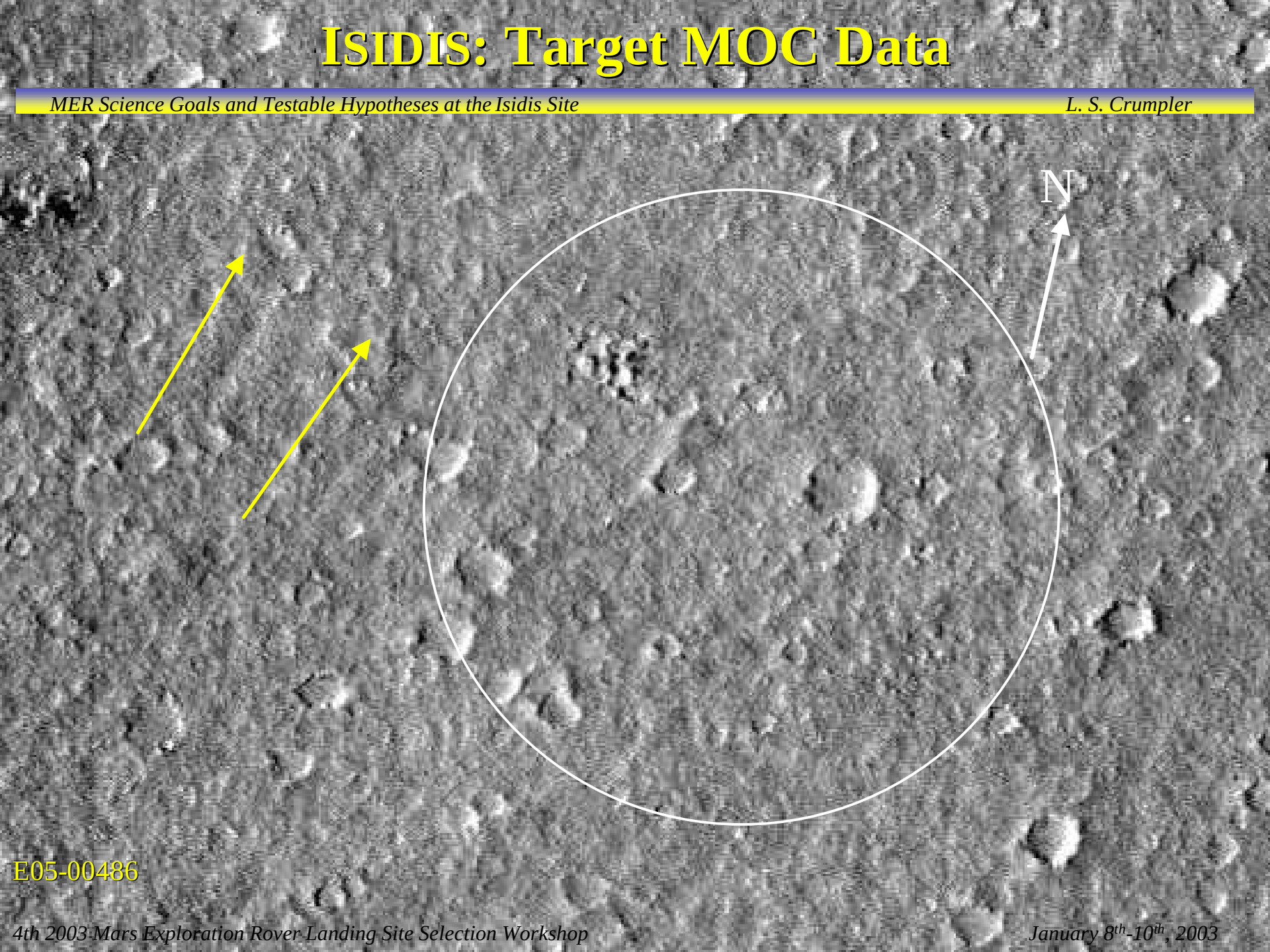


ISIDIS: Target Hypothesis

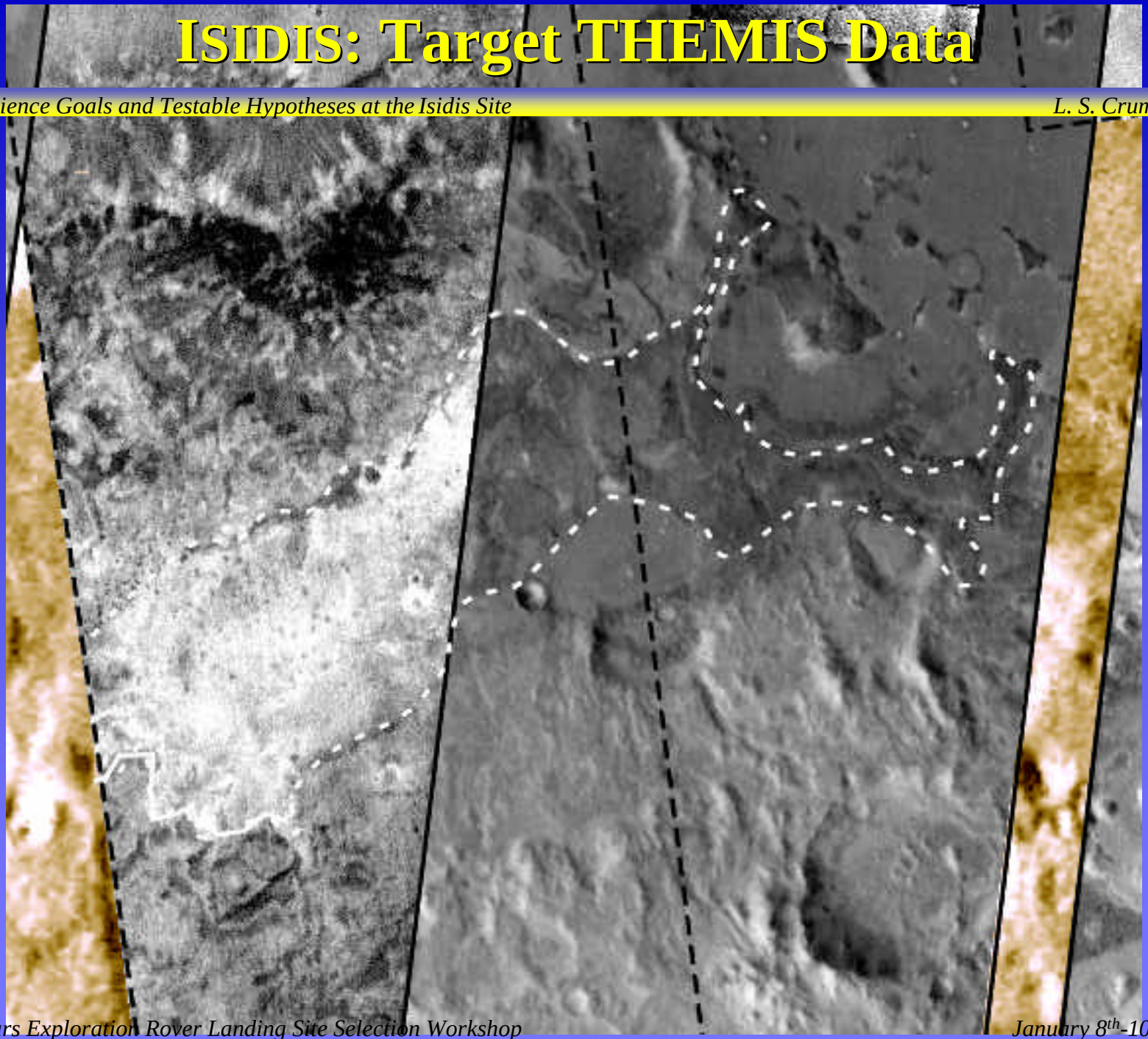


- Model: sediment fans from highlands analogous to bajadas in terrestrial range fronts

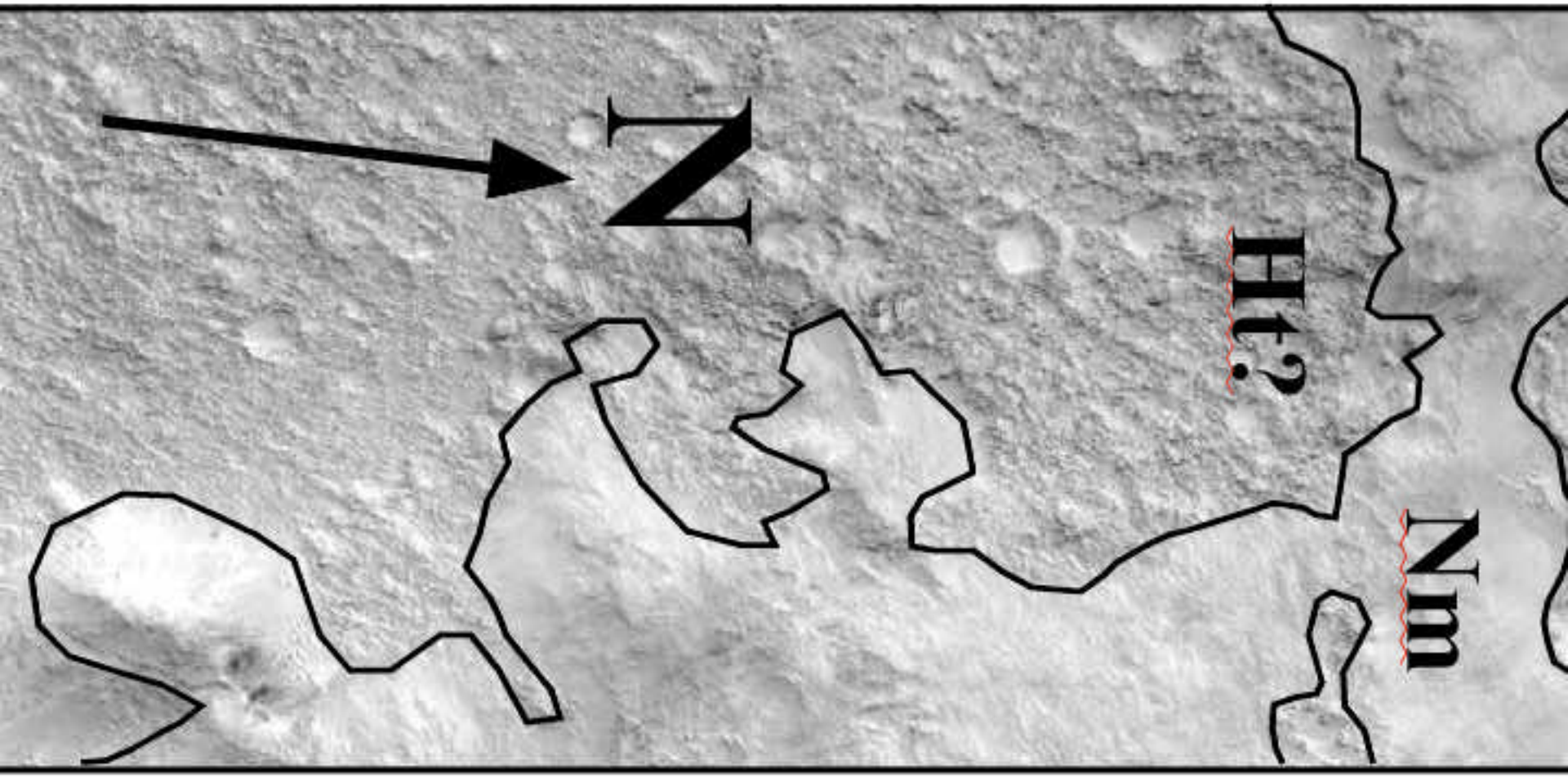
ISIDIS: Target MOC Data



ISIDIS: Target THEMIS Data

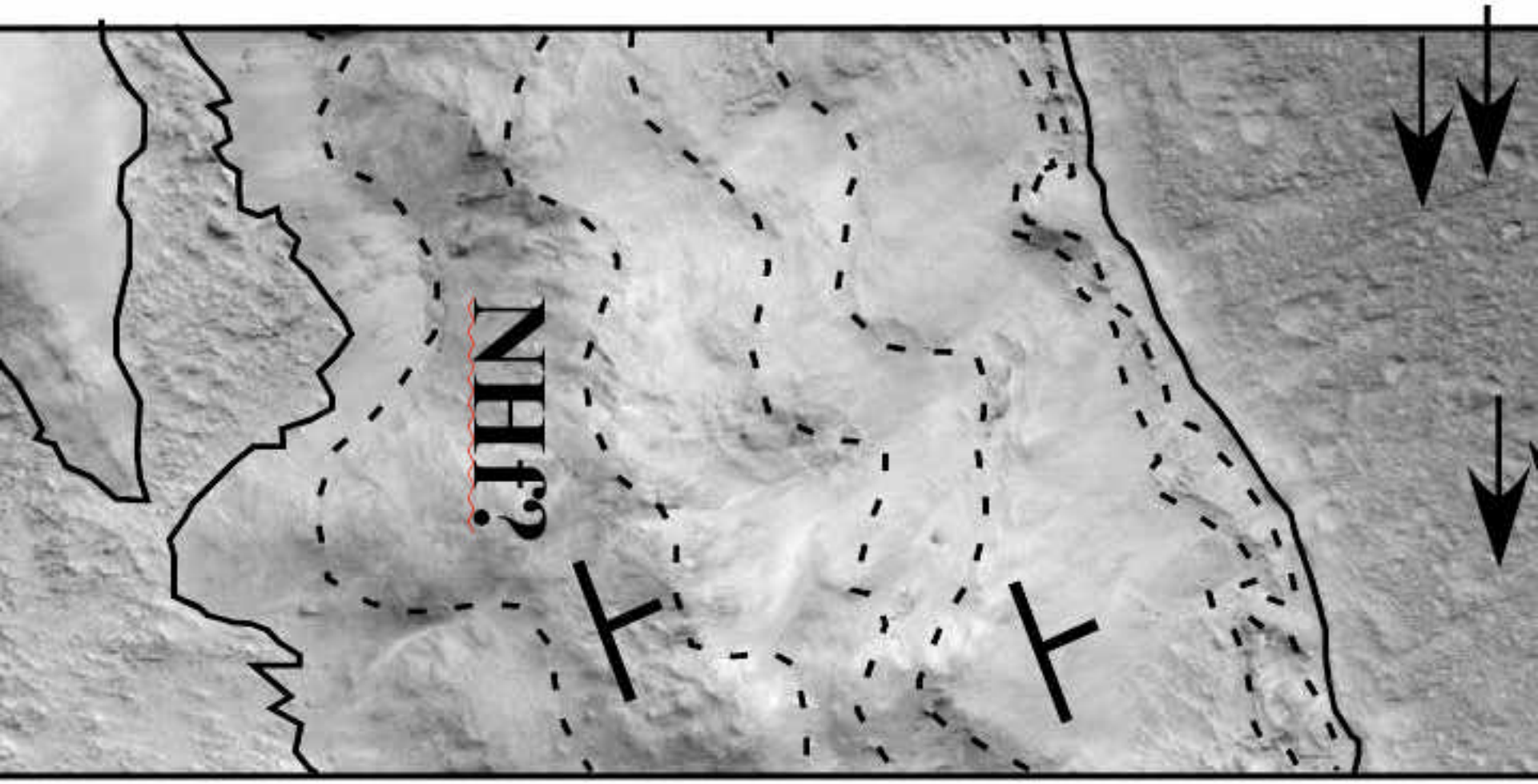


ISIDIS: Target MOC Data

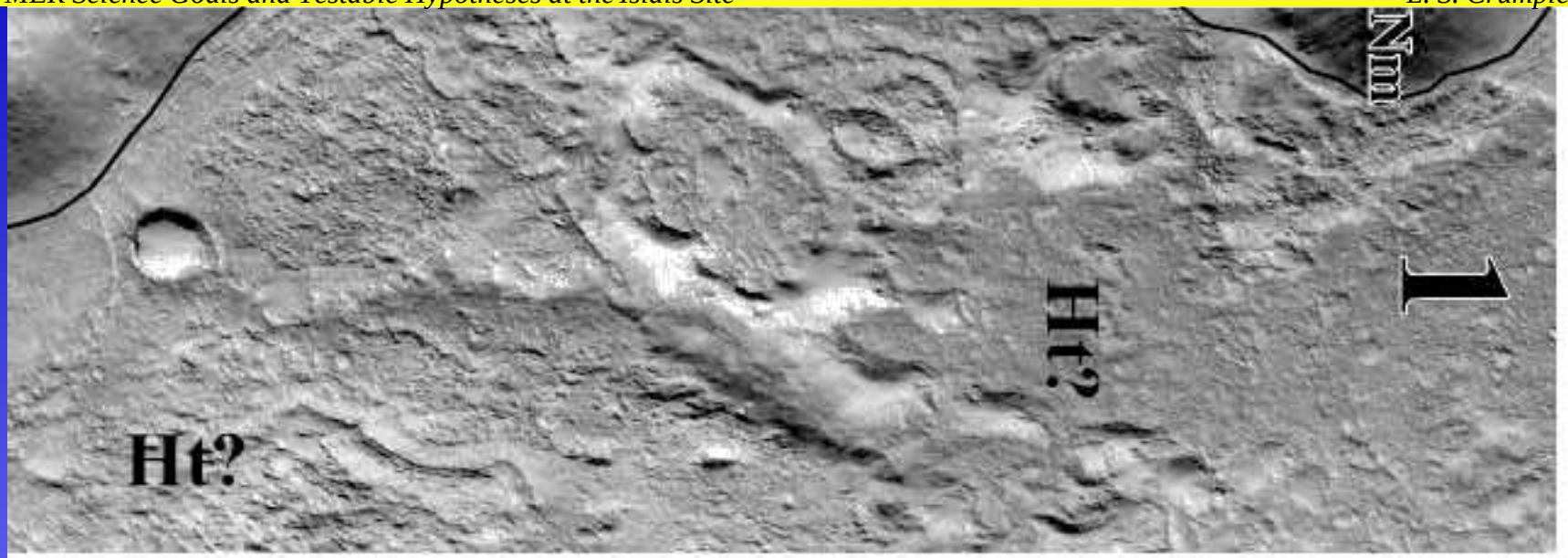


E03-000028

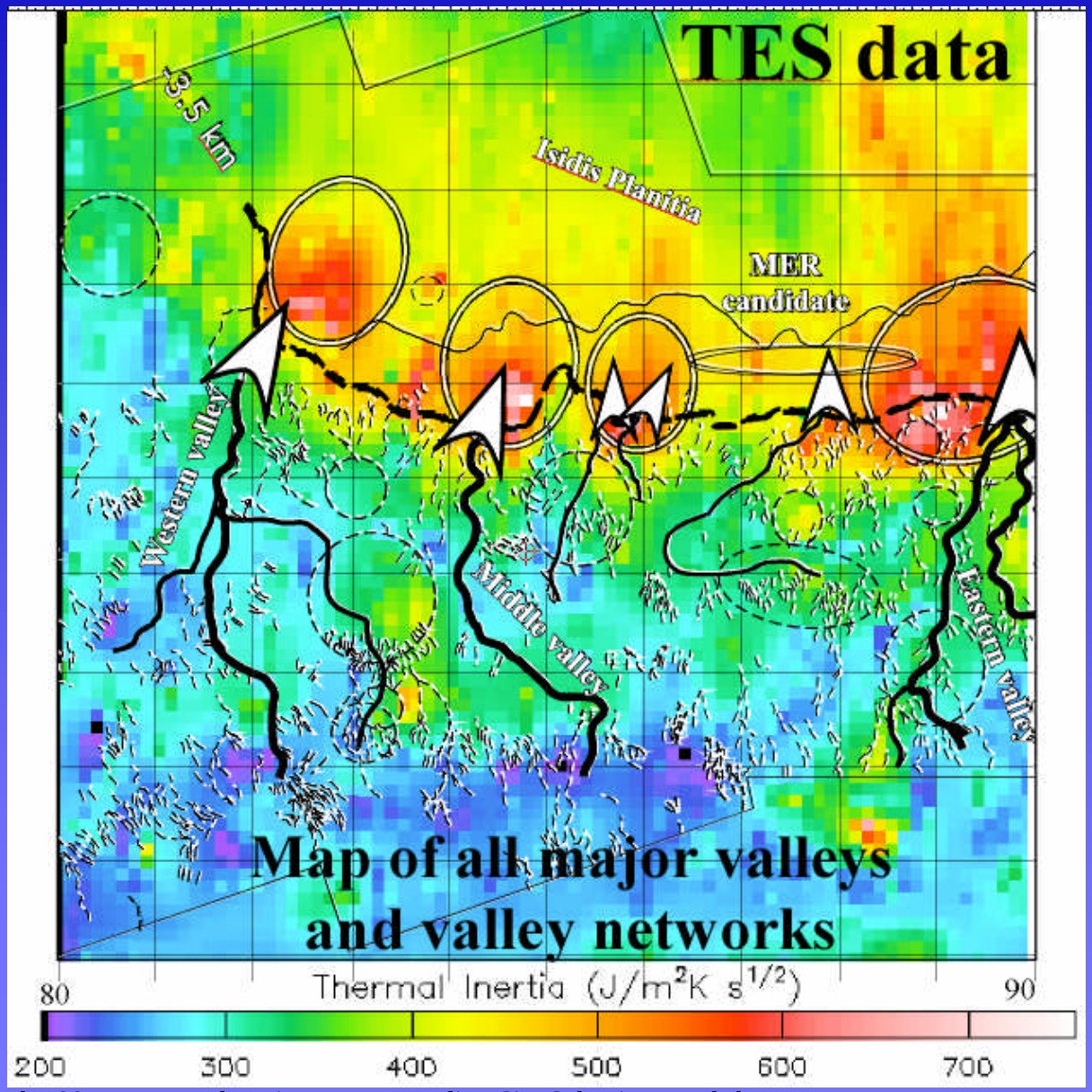
ISIDIS: Target MOC Data



Isidis: Target MOC Data



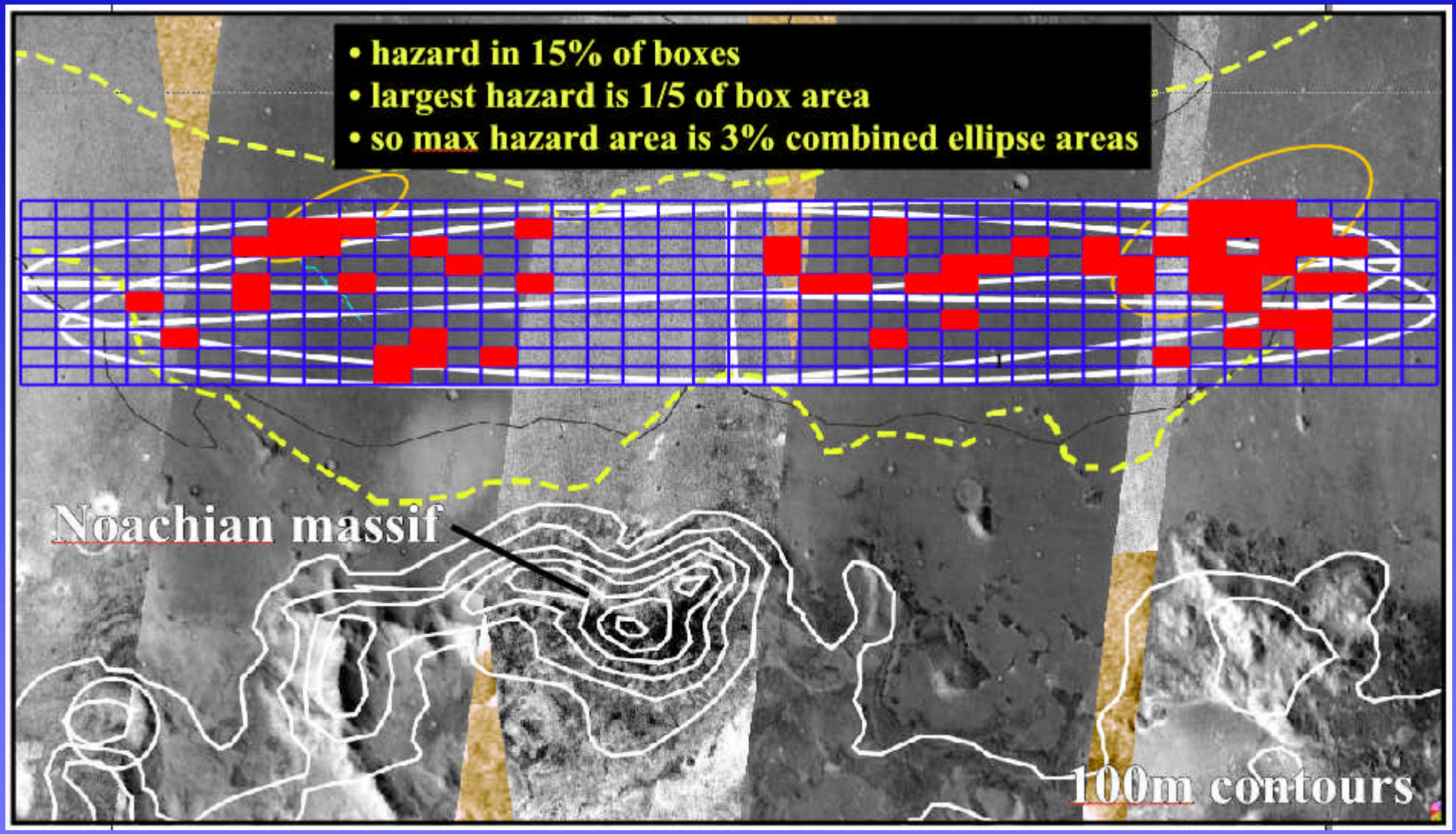
ISIDIS: Sedimentation



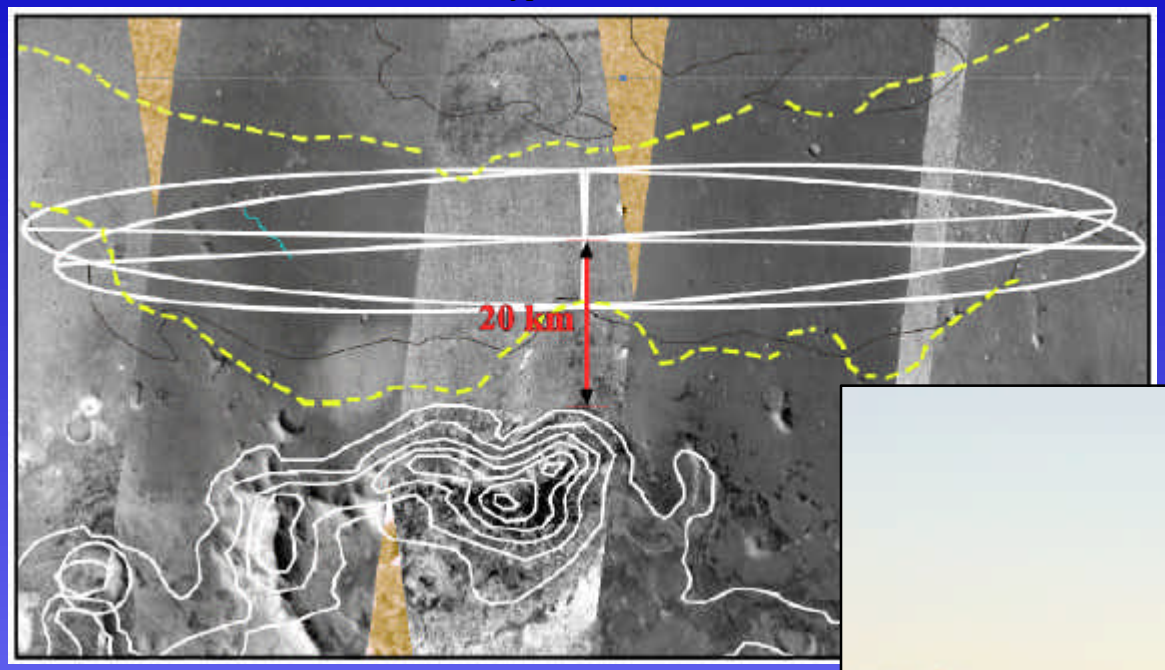
- **High valley network density**

- **High TI**
  -along rim slopes
  -at termini of major valleys

ISIDIS: Target Hazards

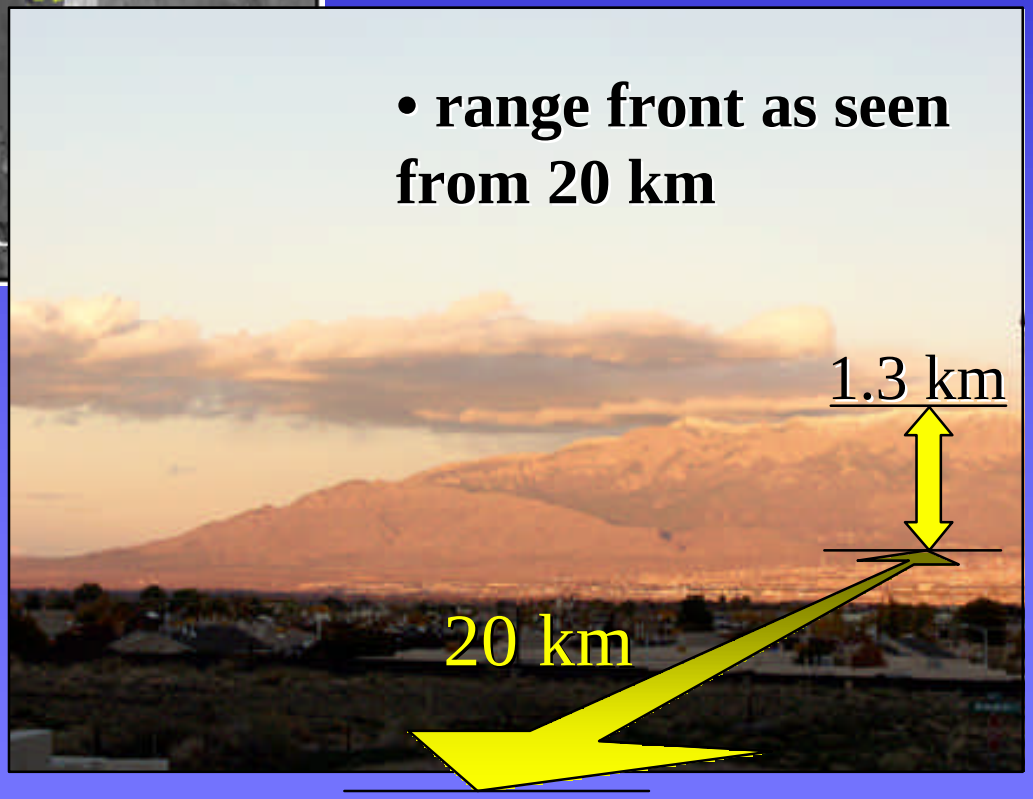


ISIDIS: Target Observables



"Mountains of Mars"

- **center of target ellipse is 20 km from Libya Montes**



ISIDIS: Target Observables

A Strength of the Athena IDD instruments: Observing Rocks

- rock abundance at Isidis ~13-14%

ISIDIS: Target Observables

The big programmatic level testable hypothesis at Isidis involves rocks:

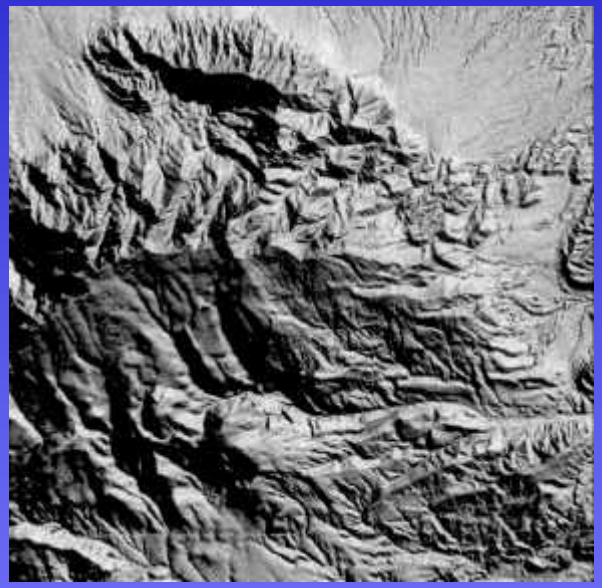
Do the highland rocks, which are derived from one of the classic fluvially-modified terrains, dating from the earliest epoch of Mars, show evidence for modification by water?

Yes or No?

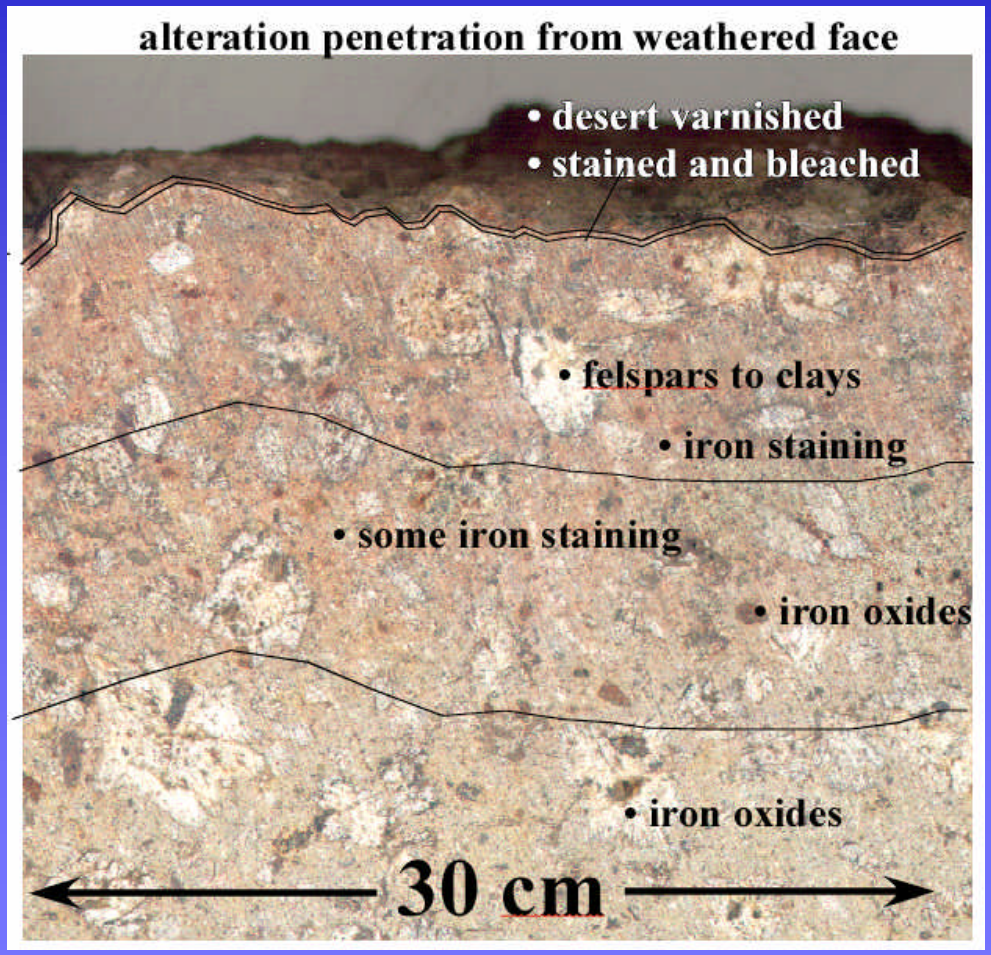
ISIDIS: Target Observables

Evidence for long-term presence of water

- **rocks that have seen this……** **……. look like this**



- **areas of valleys may be areas of saturated groundwater flow**



ISIDIS: Target Observables

- **water penetration along fractures**

- **general mineral modification proceses**
  - **-MI**
  - **-RAT**
  - **-Mossbauer**
  - **-APXS**

ISIDIS: Target Observables

PANCAM

- assess presence of sedimentary structures
- assess presence of fan morphology
    - gravel bars, boulder fans and gravel interfluves
    - arroyo-like incision
    - rounded rocks
- assess presence of near-shore morphologies
    - beach ridges
- assess presence and absence of different rock morphologies
    - different rocks in highlands
    - different rock modification processes (macro-textures)
- assess characteristics of massifs
    - structure
    - morphology
- assess atmospheric opacity using range front
- monitor atmospheric variations at range front as a function of
    - time
    - solar phase angle
    - atmospheric absorption

ISIDIS: Target Observables

Mini-TES

-assess spectral character of highland rocks
-test by comparison with massif spectra and orbital data
-assess diversity, including potential substrate differences (near impacts)

APXS

-chemical composition of highland rocks
-chemical composition of fines (same or not)
-chemical composition of aeolian fines
-presence of aqueous minerals in fines

ISIDIS: Target Observables

Microscopic Imager

-pristine or modified minerals
-staining
-secondary minerals in interstices between grains
-grain sizes of differing macro-textured rocks

Mossbauer

-transverse differences in iron mineralogy
-differences in iron mineralogy for rounded vs angular

ISIDIS: Target Observables

RAT

(- need rocks to use it)

- need RAT to do many of the above
  - MI point counts and grain-size distribution
- also coatings
  - presence or absence
  - how thick?
  - physical properties
    - hard rock or altered

ISIDIS: "SWAT"

Strengths

- lots of rocks to use the Athena instruments on
- oldest unit, earliest time of fluvial activity
- centralized goal that relates to MEP
- the view
- either MER A or B applicable

Weaknesses

- may not have preserved small sedimentary structures
- not a "layer cake"

Threats

- lots of rocks, could impede long traverse
- autonomous "gain control" on "low"