



High-resolution measurements of Mercury's surface composition with the MESSENGER X-Ray Spectrometer

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Data

X-Ray Spectrometer (XRS) data collected April 2011
through April 2015:

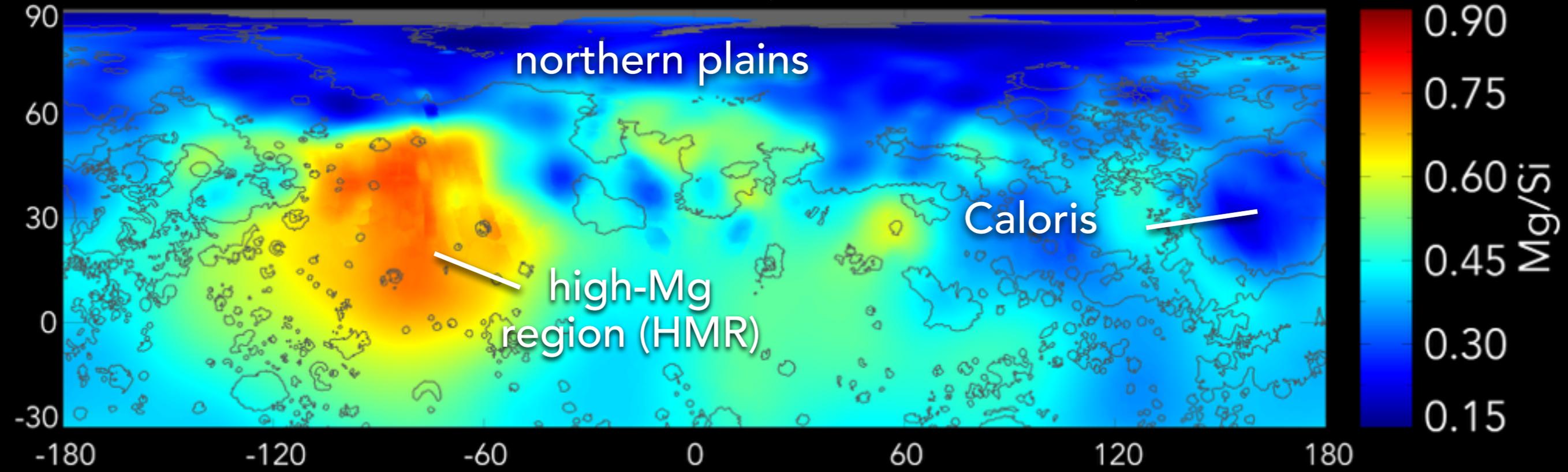
~19,000 quiet-Sun spectra (Mg, Al, Si)

~1,800 flare analyses (Mg, Al, Si, S, Ca, Ti, Fe)

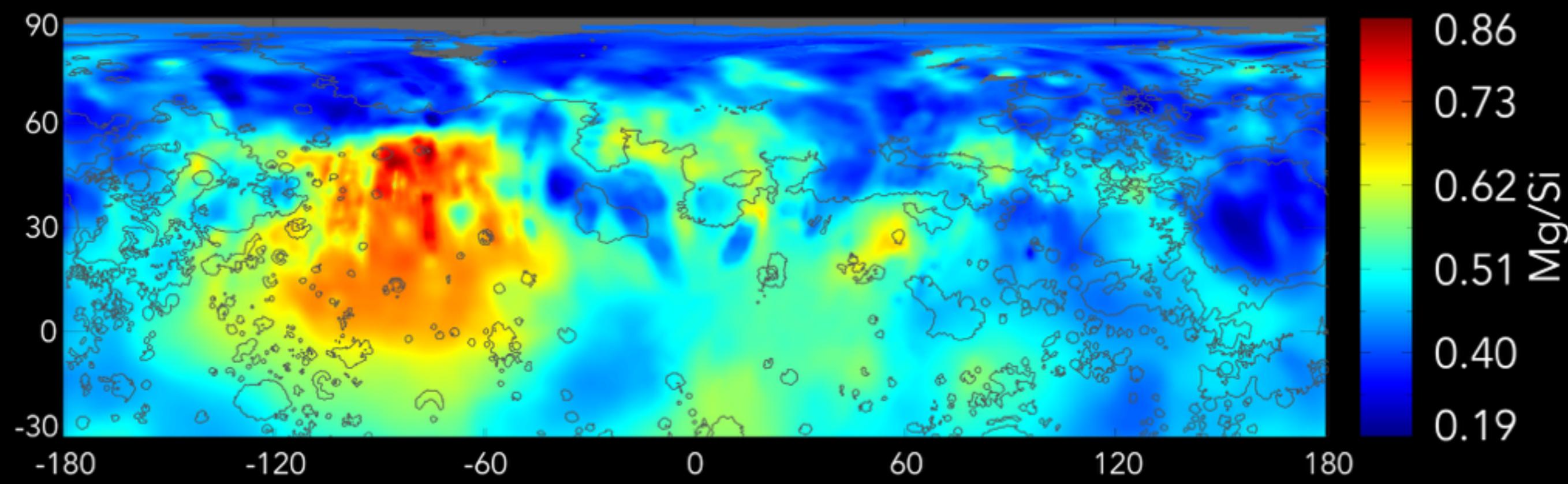
Observations from the low-altitude campaign have
allowed us to resolve geological-scale features.

Maps: Mg/Si

December 2013 (Weider et al. 2015)

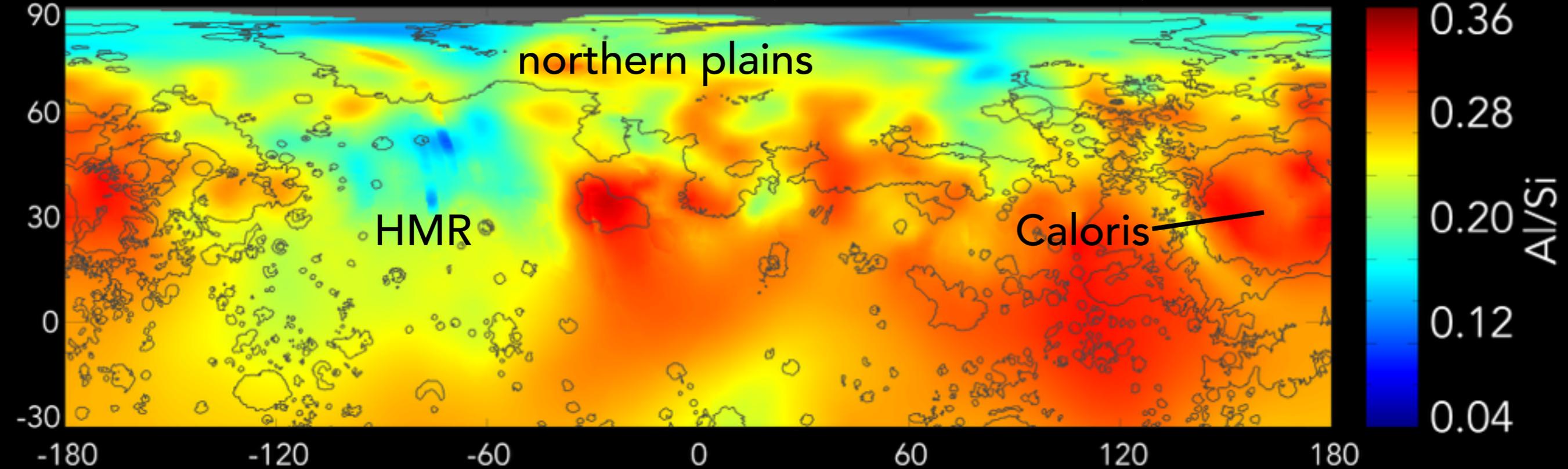


New

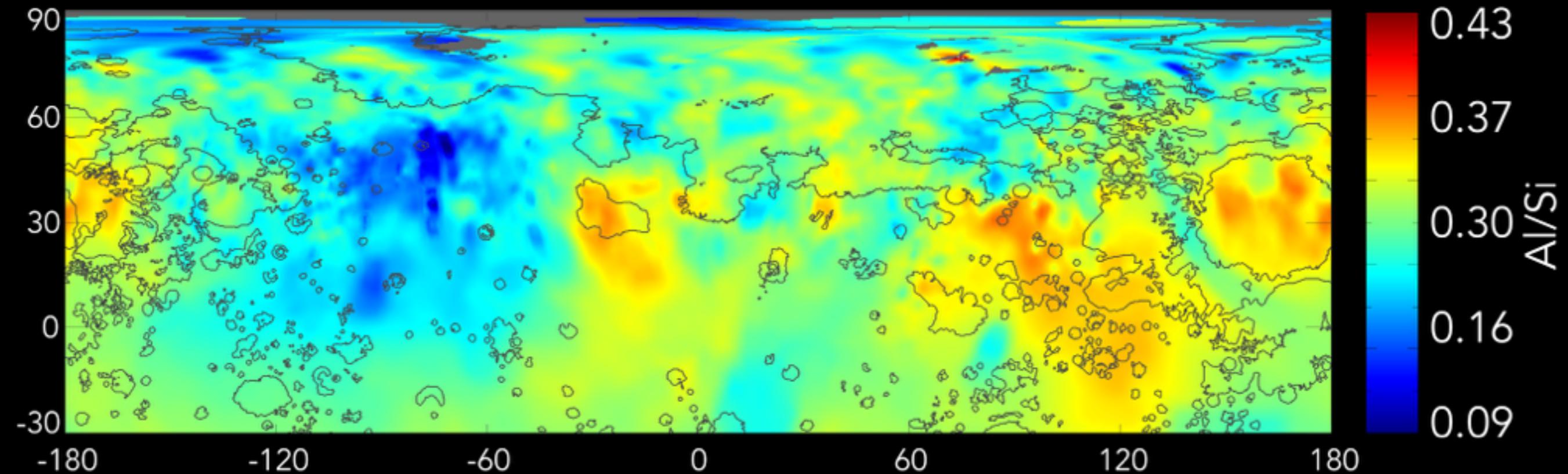


Maps: Al/Si

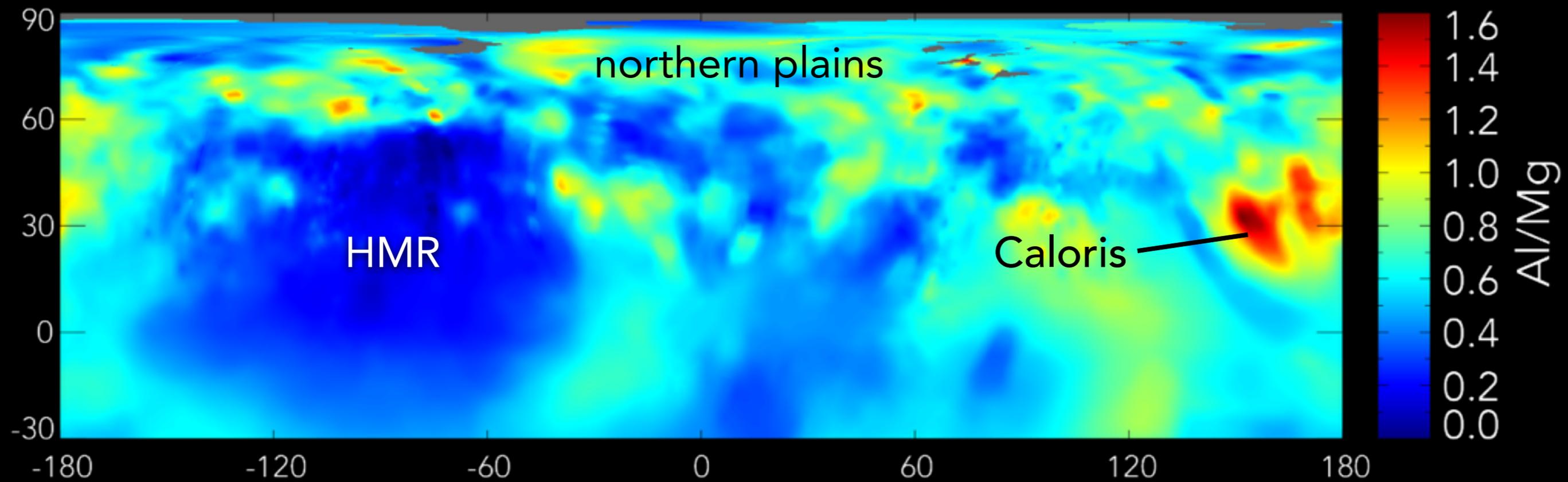
December 2013 (Weider et al. 2015)



New

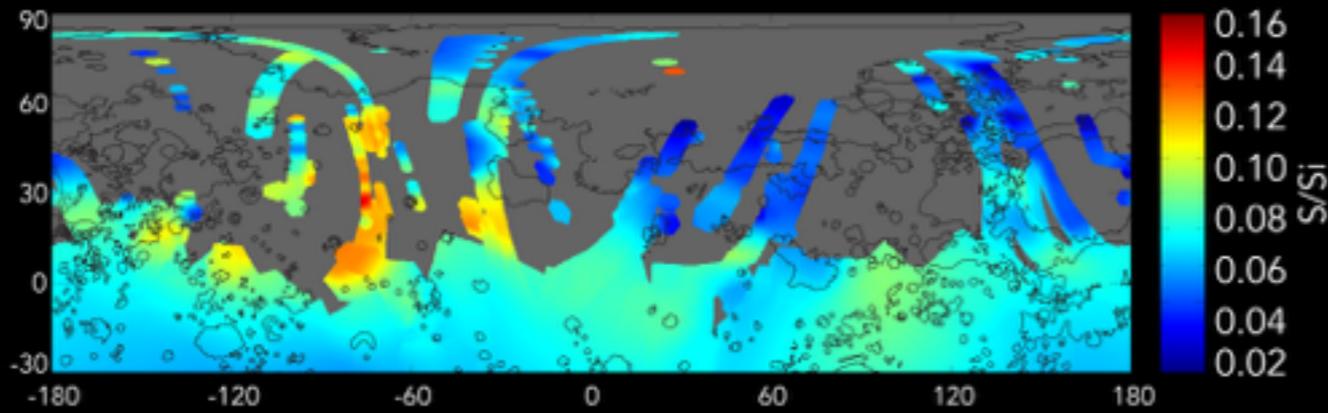


Maps: Al/Mg

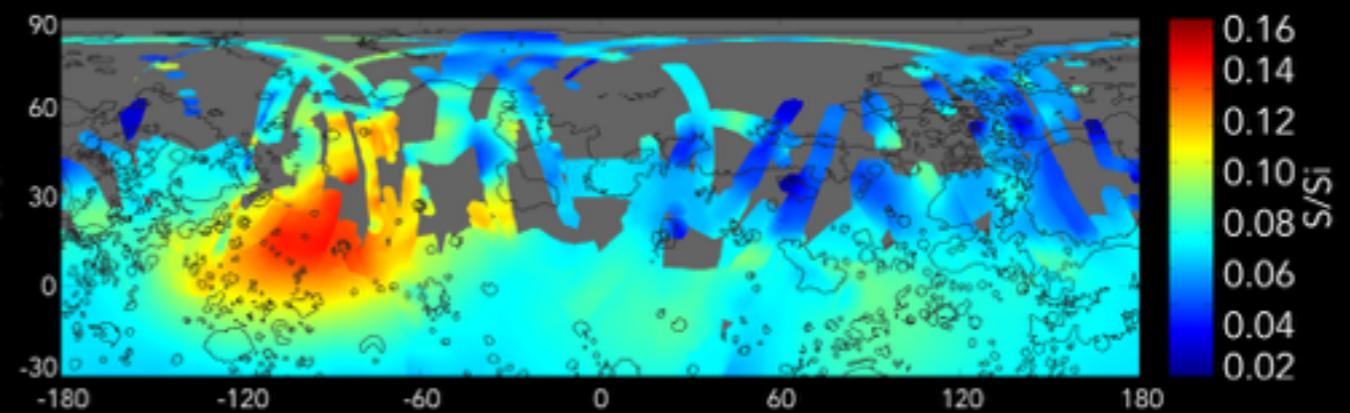


Maps: S/Si, Ca/Si, Fe/Si

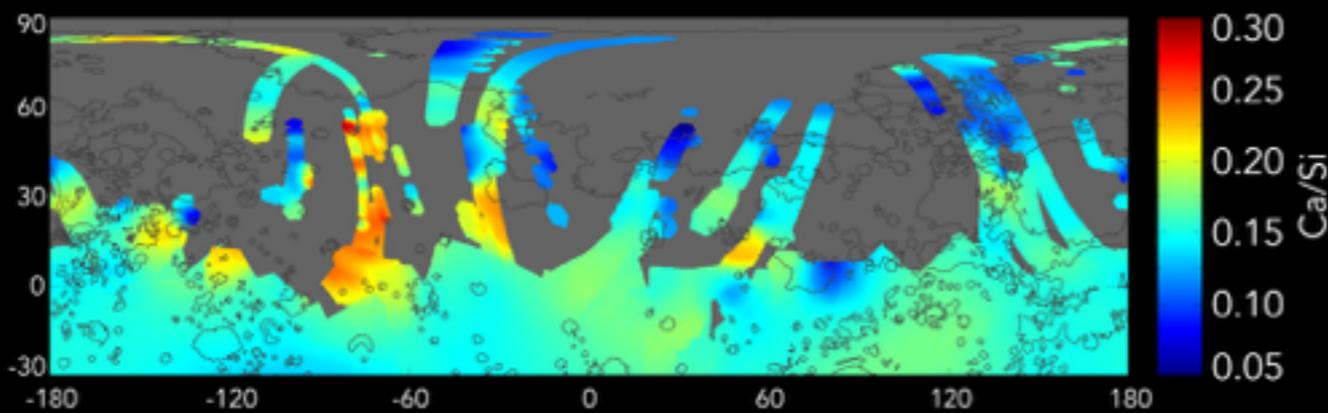
Previous S/Si



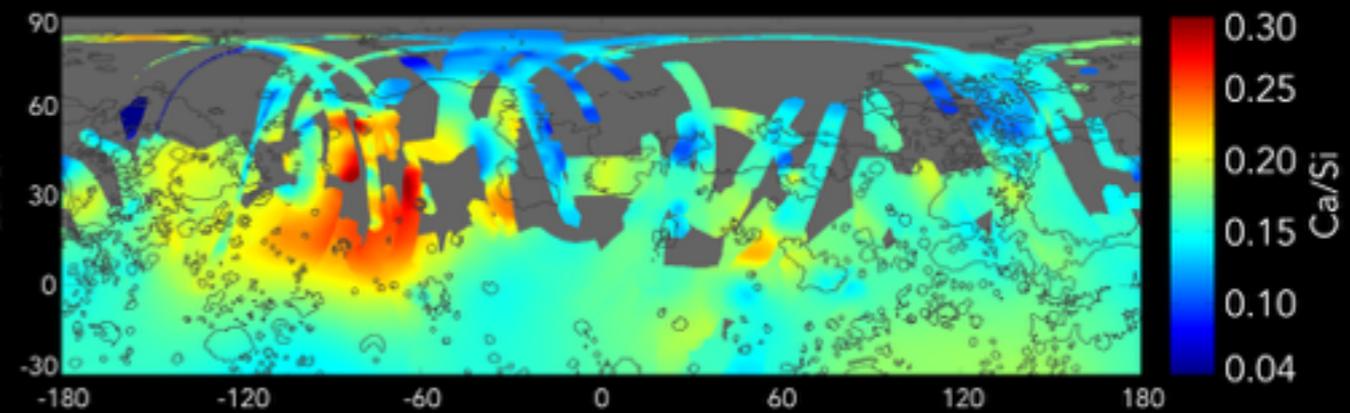
New S/Si



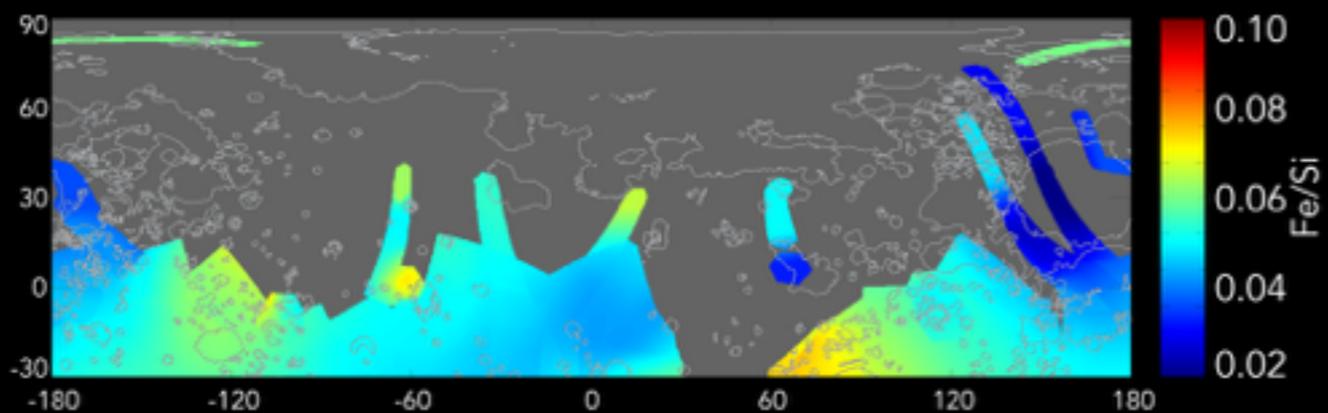
Previous Ca/Si



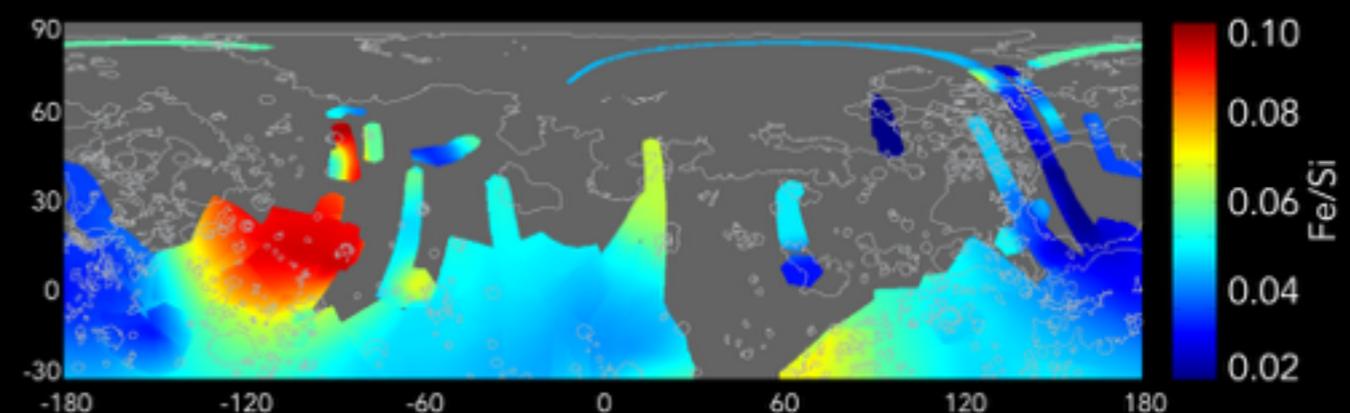
New Ca/Si



Previous Fe/Si

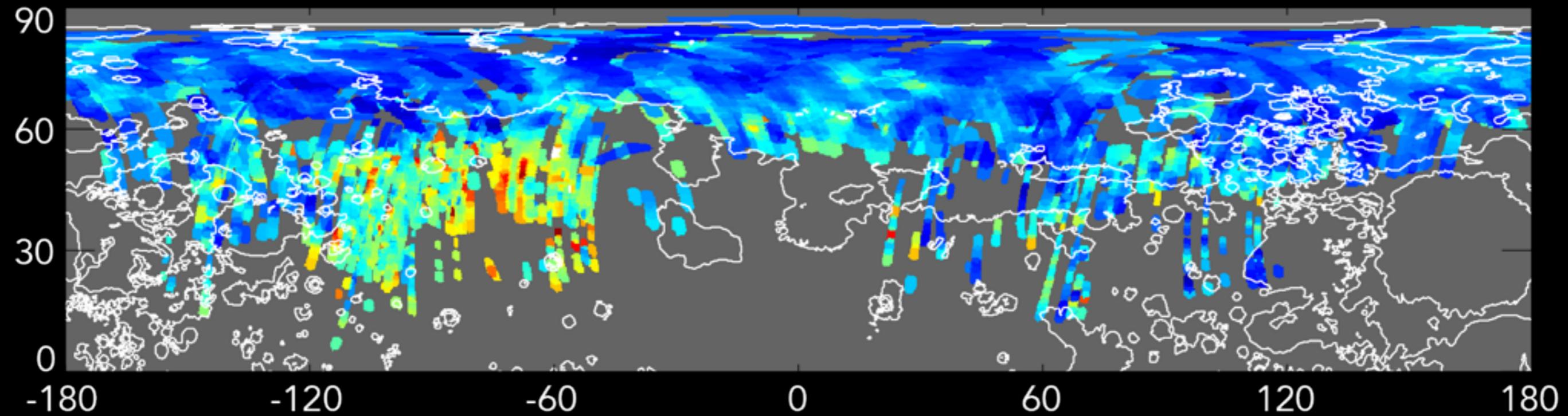


New Fe/Si



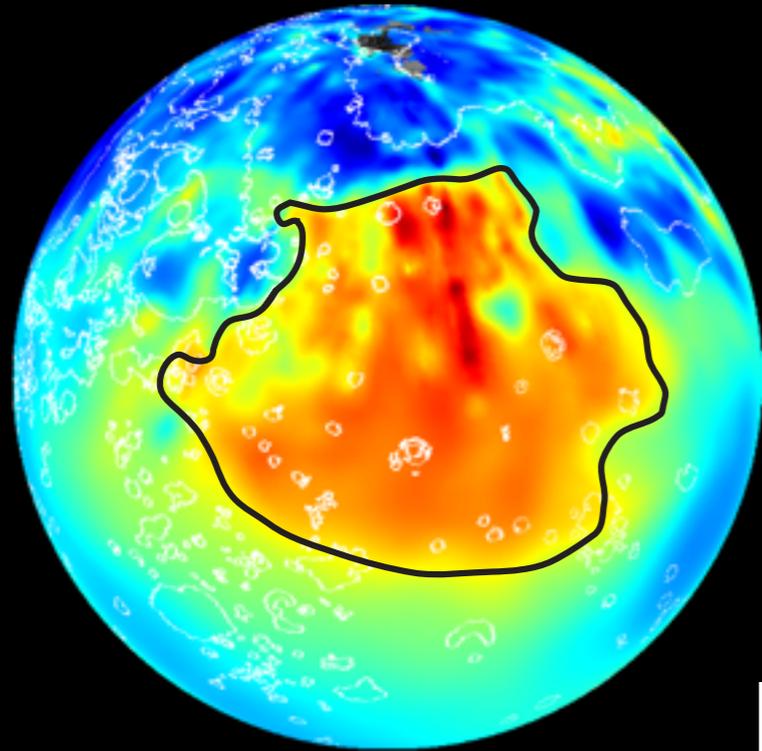
previous maps from Weider et al. (2015)

Maps: Mg/Si, footprints <100 km across

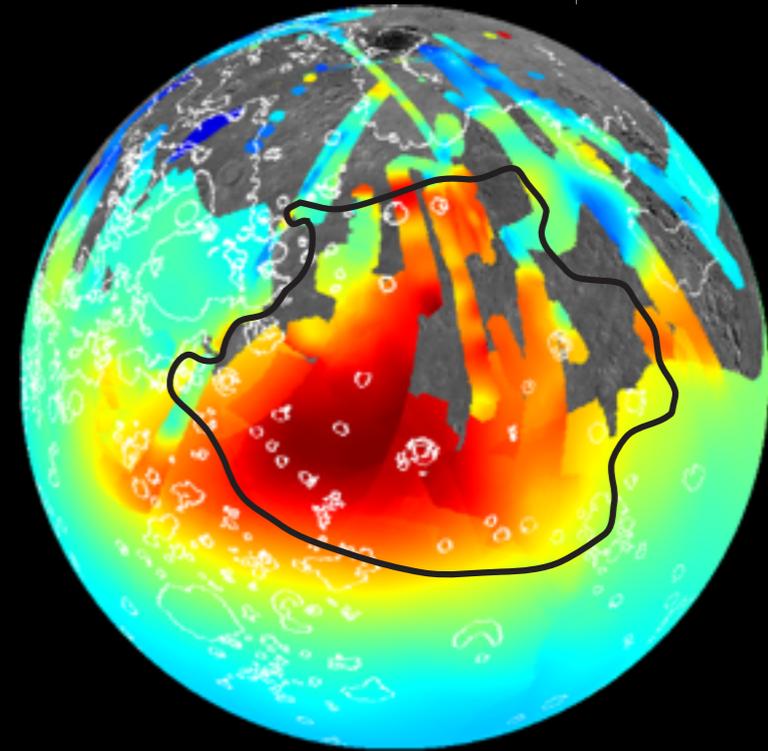


Features of interest: High-Mg region (HMR)

Mg/Si

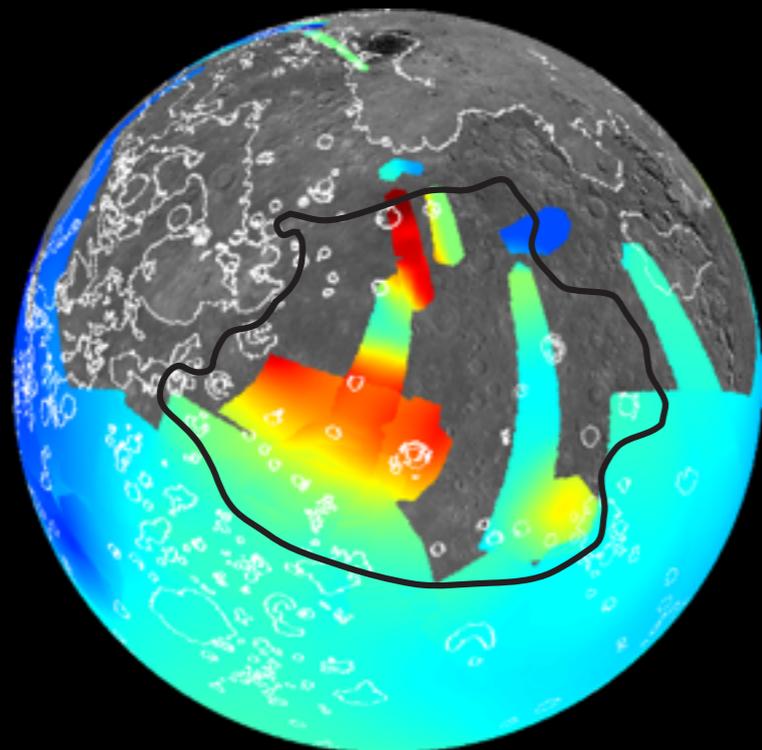


S/Si

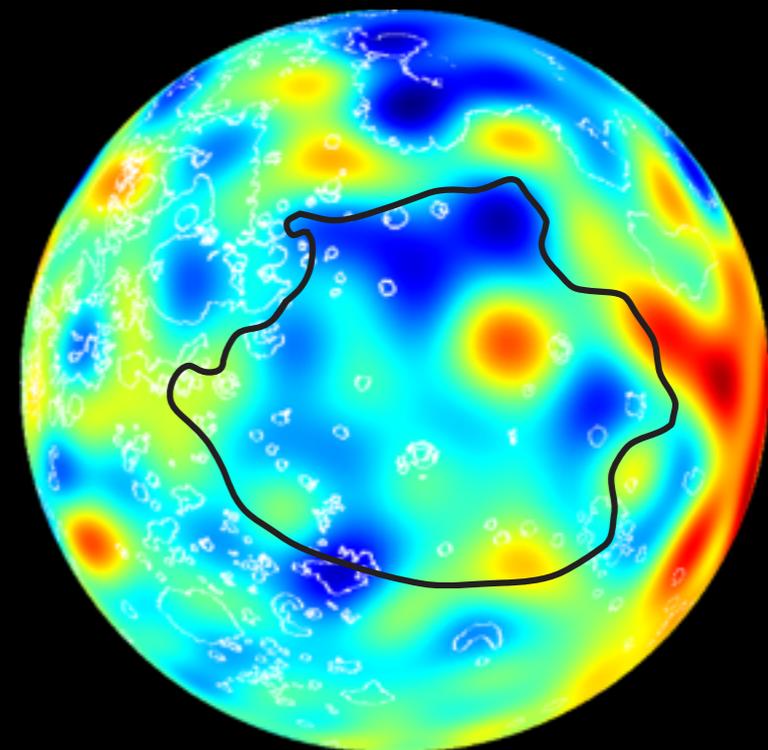


Impact basin?¹

Fe/Si



crustal thickness²

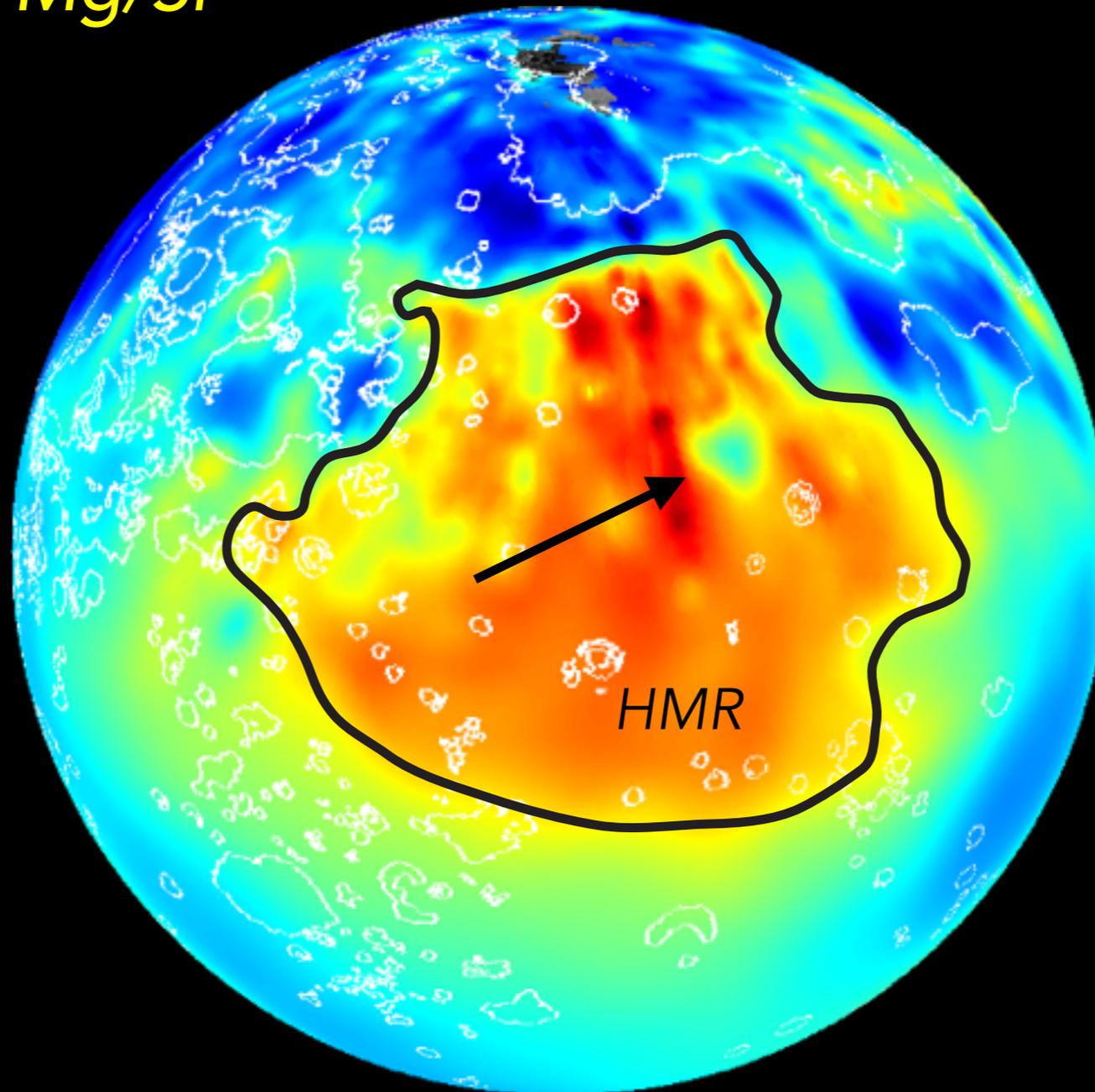


¹Weider et al. 2015

²James et al. 2014

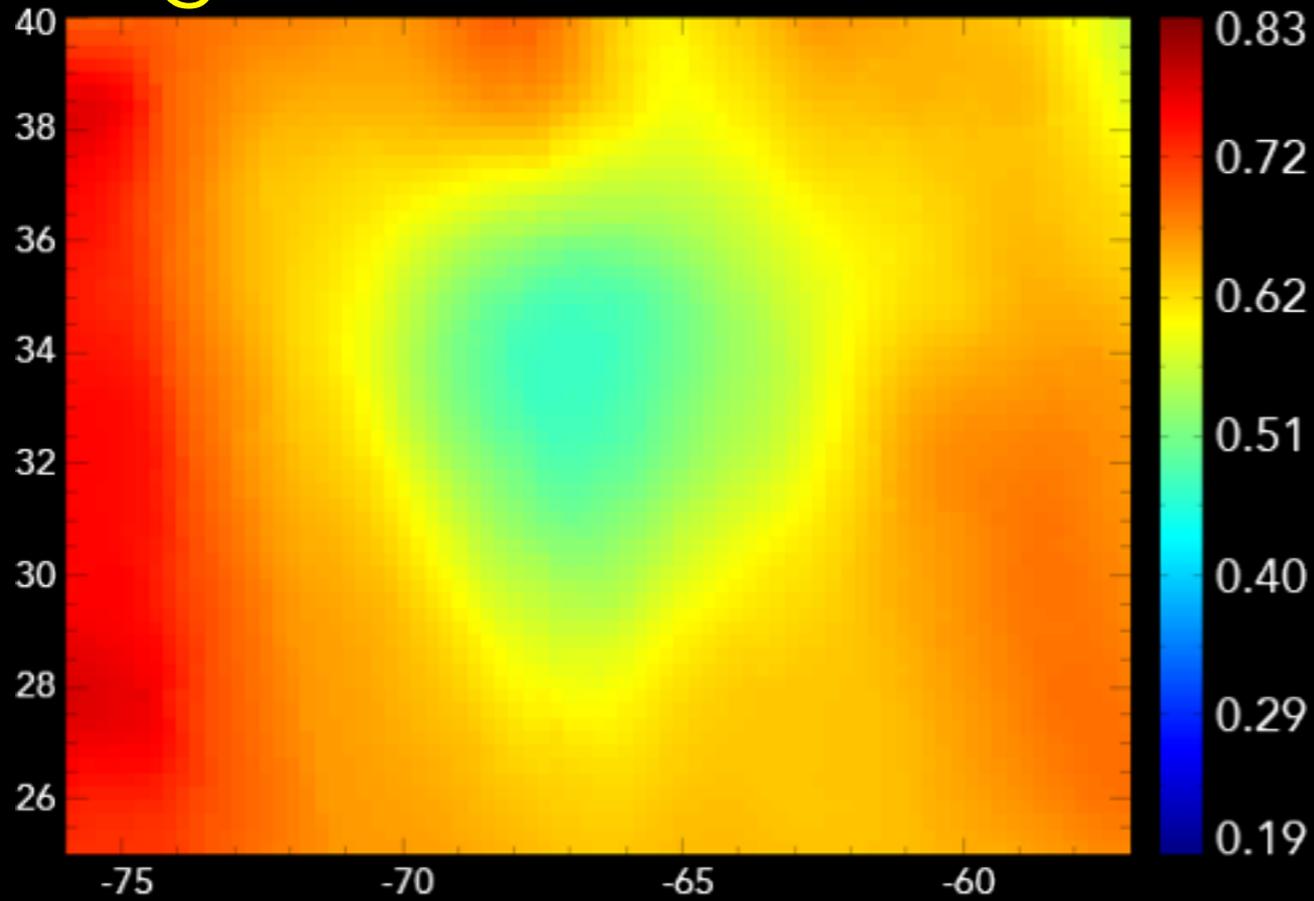
Features of interest: Crater in HMR

Mg/Si

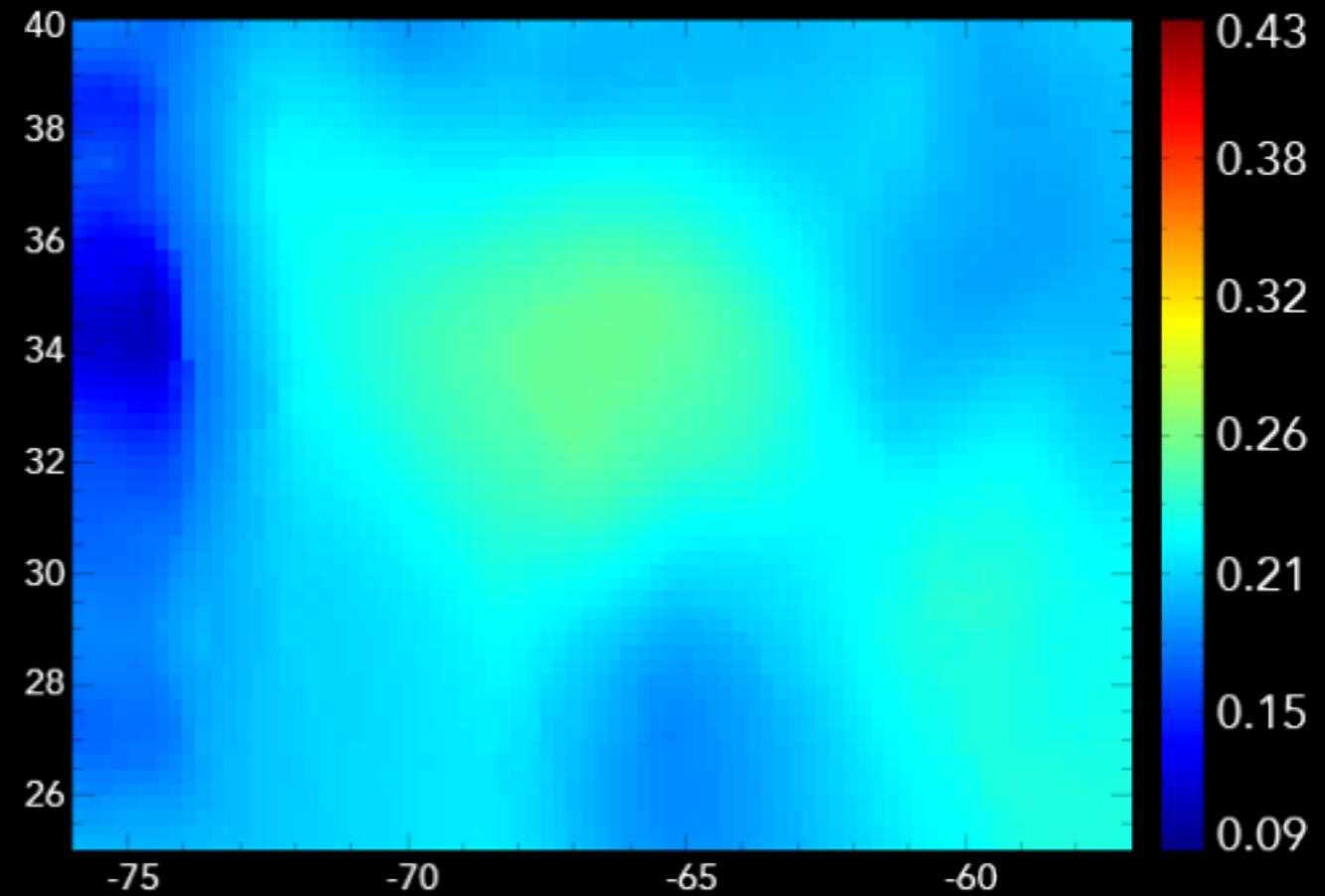


Features of interest: Crater in HMR

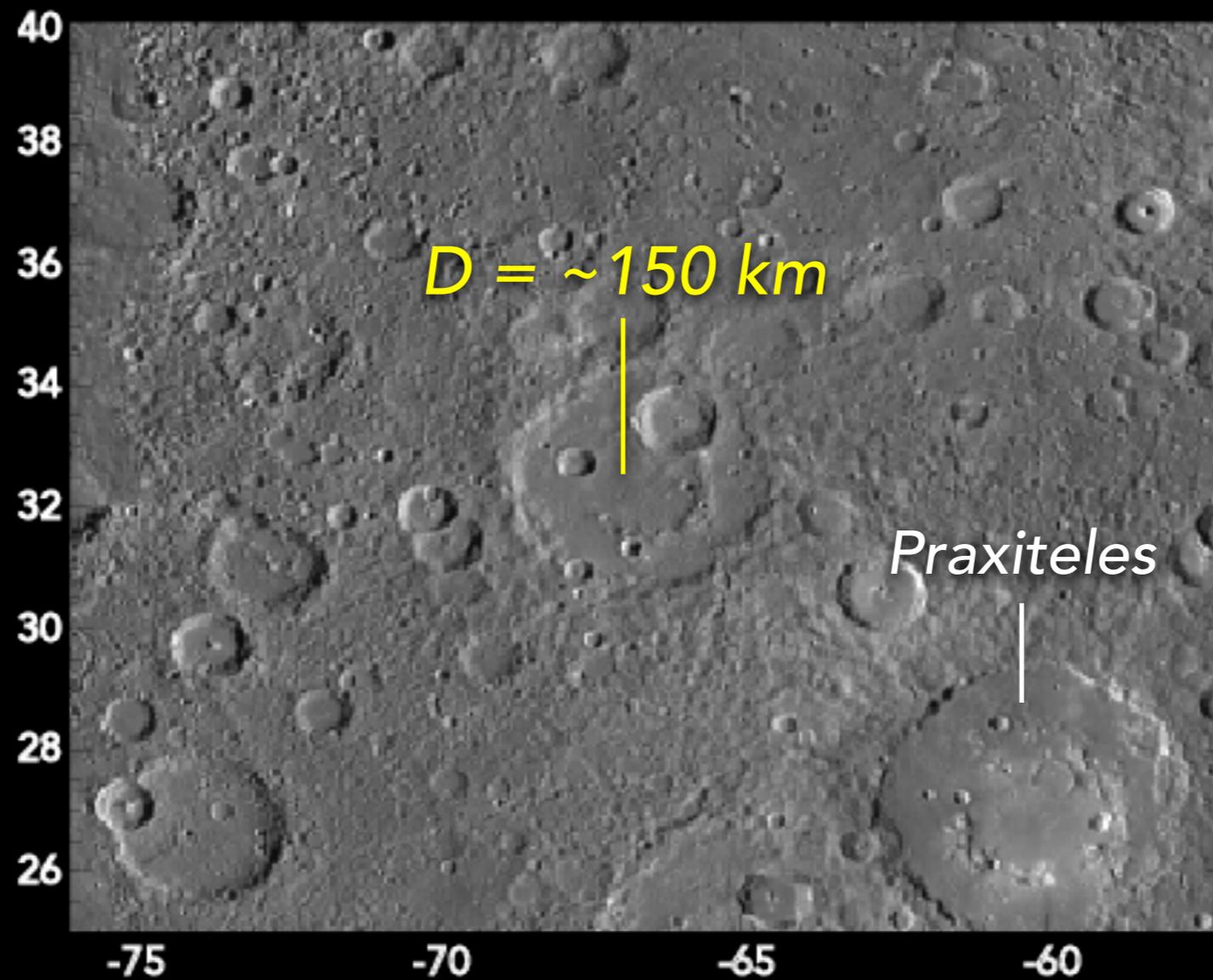
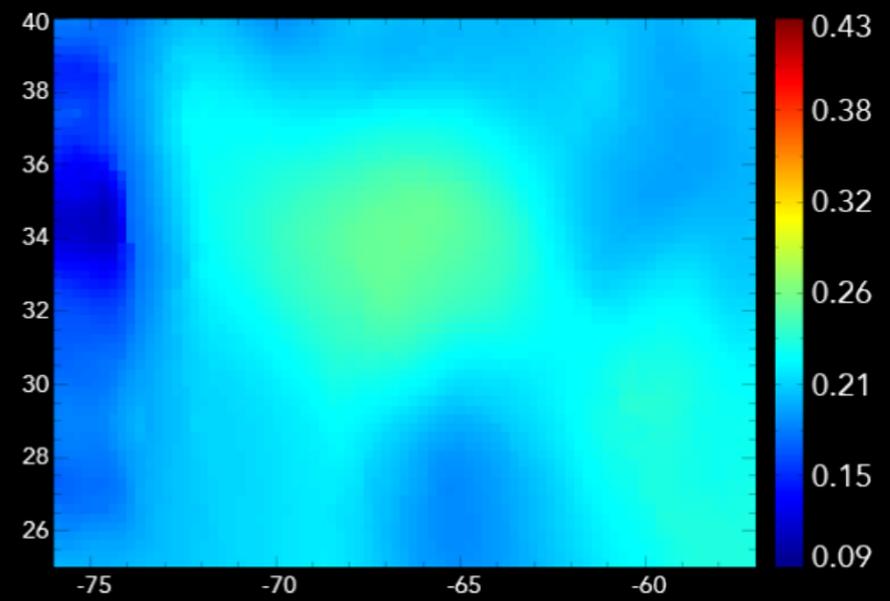
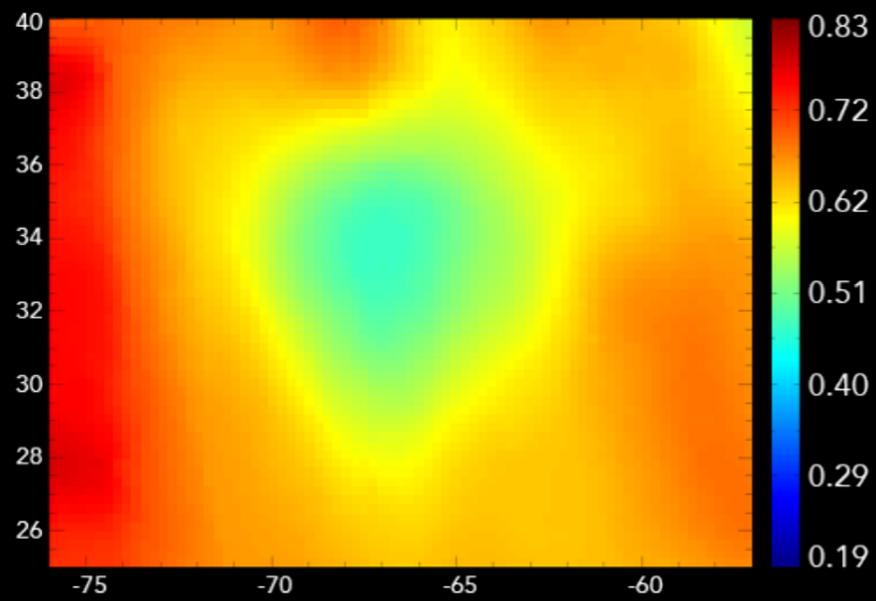
Mg/Si



Al/Si

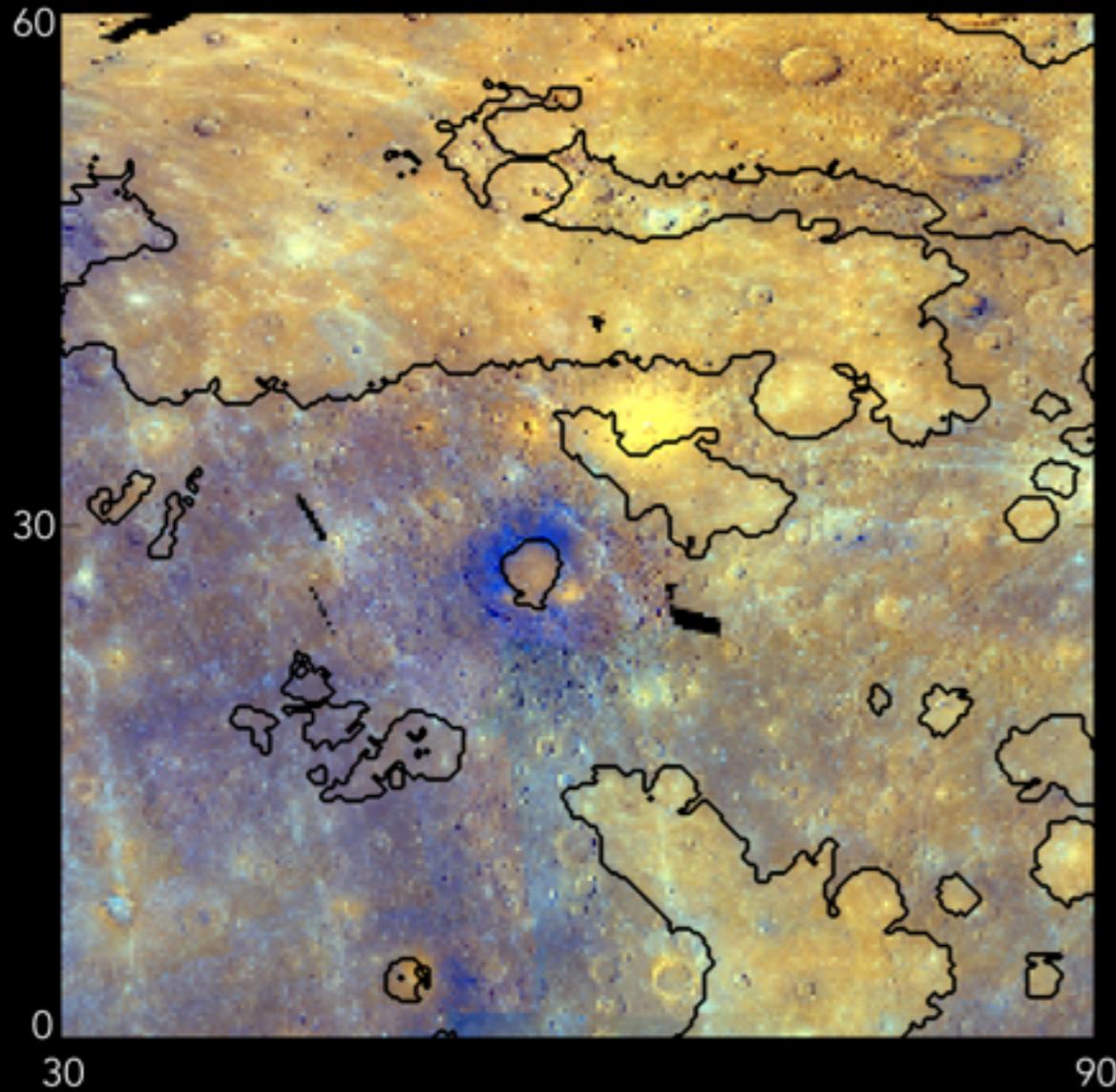


Features of interest: Crater in HMR

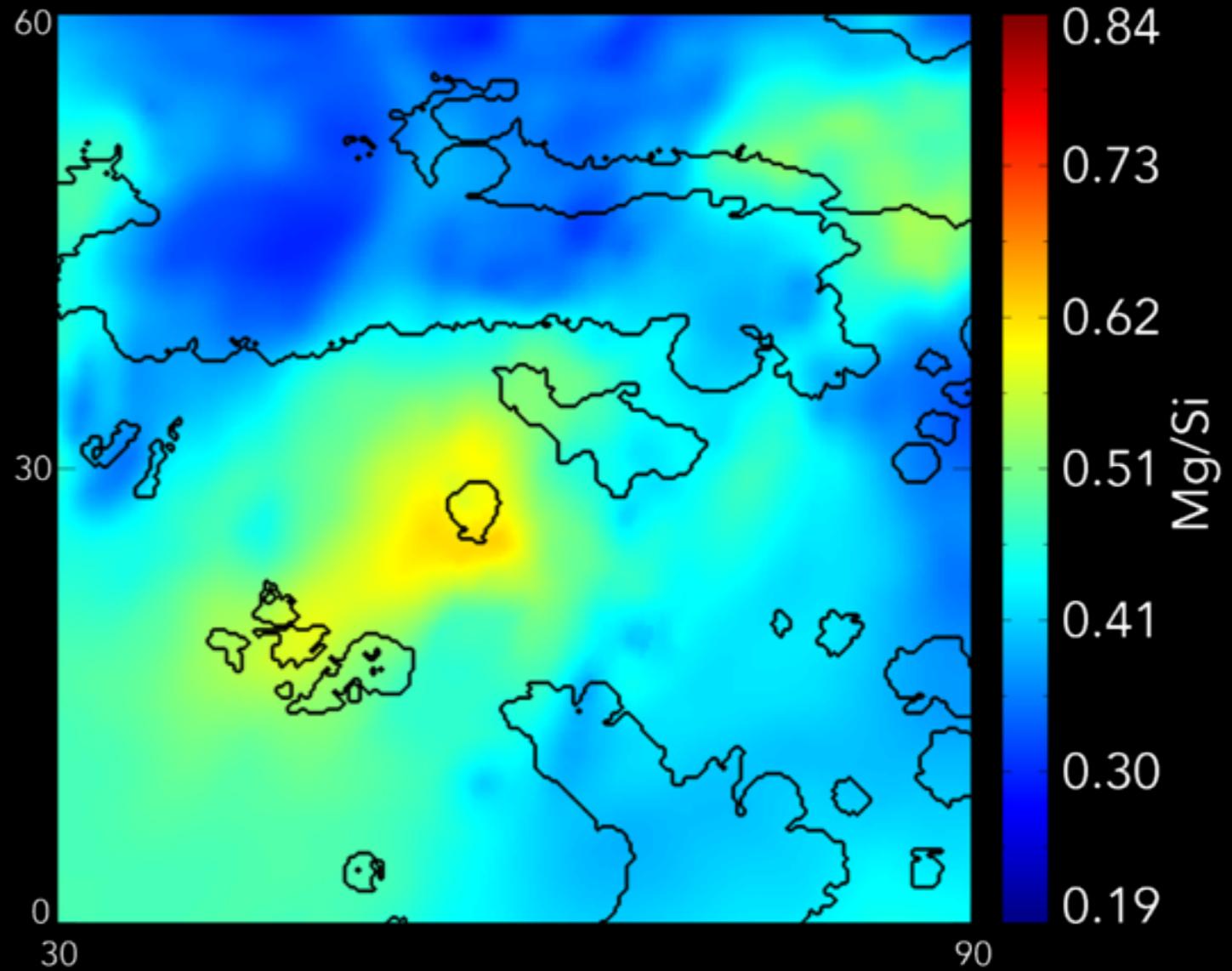


Features of interest: Rachmaninoff

MDIS enhanced color

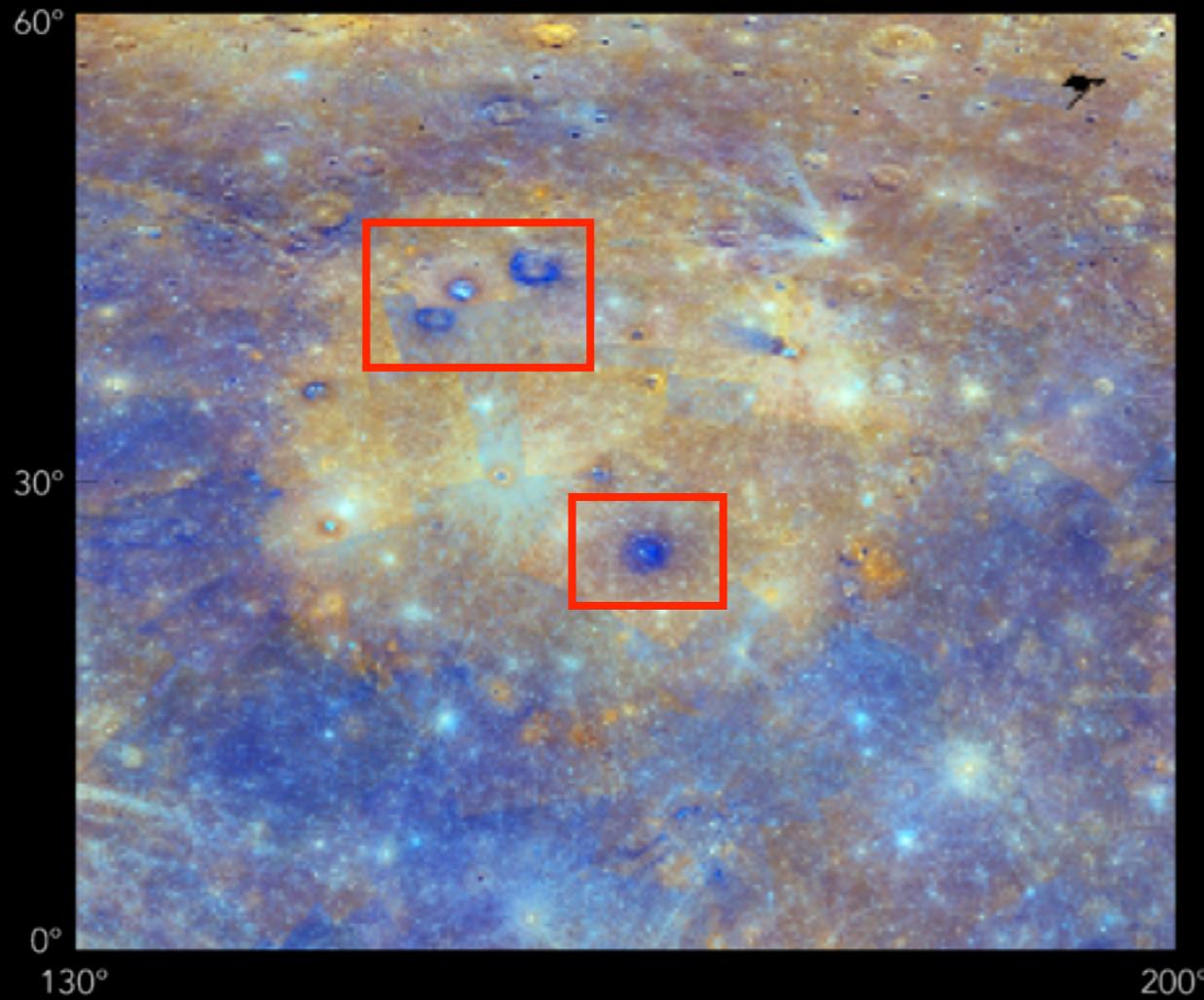


Mg/Si

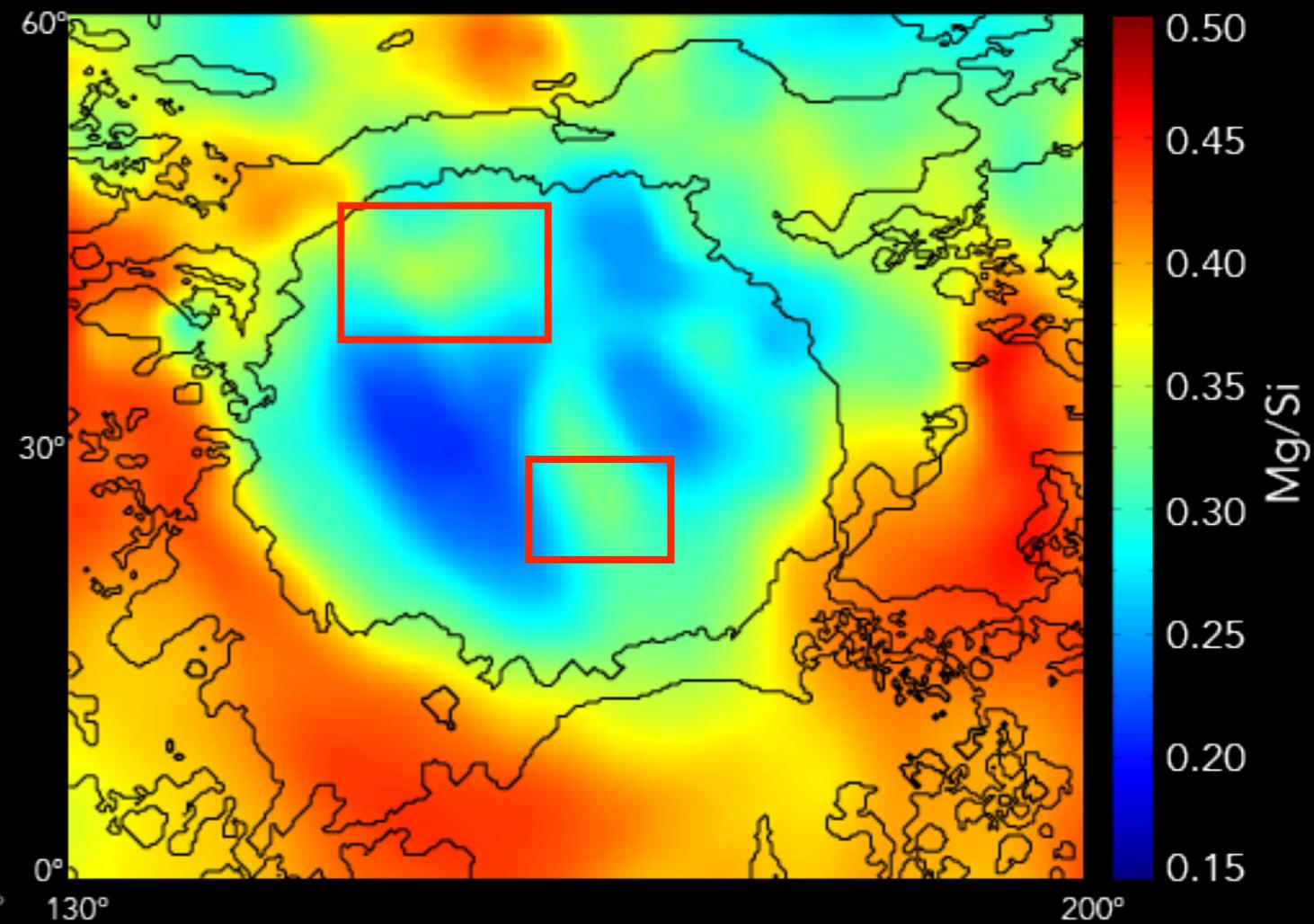


Features of interest: Caloris

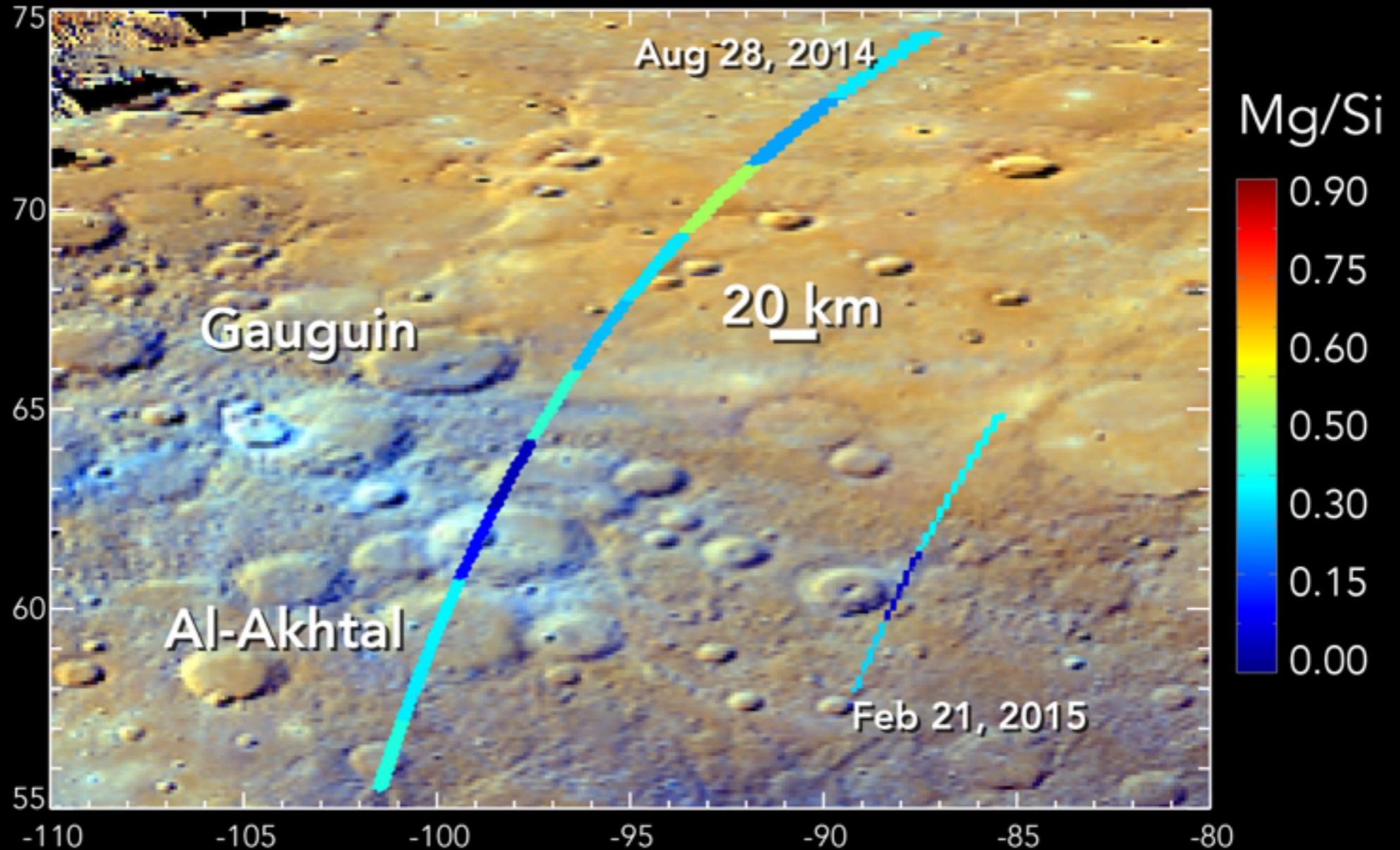
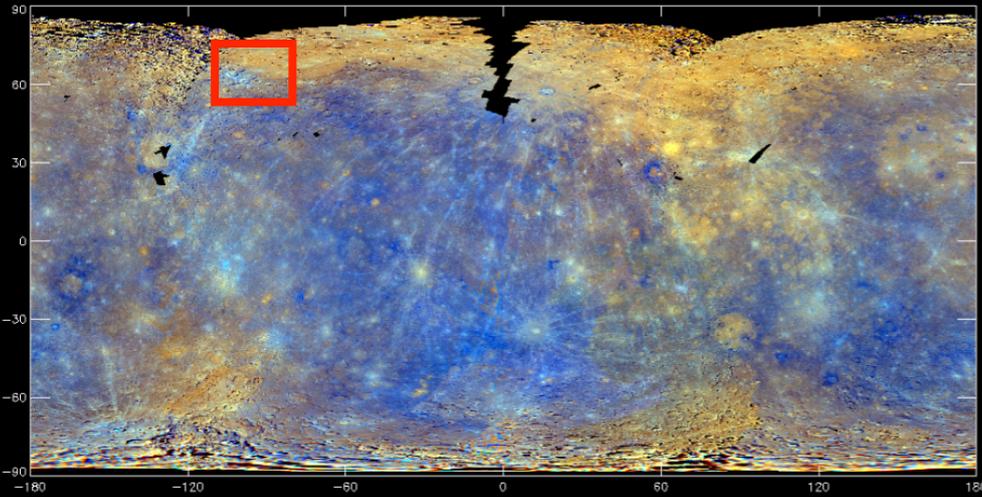
MDIS enhanced color



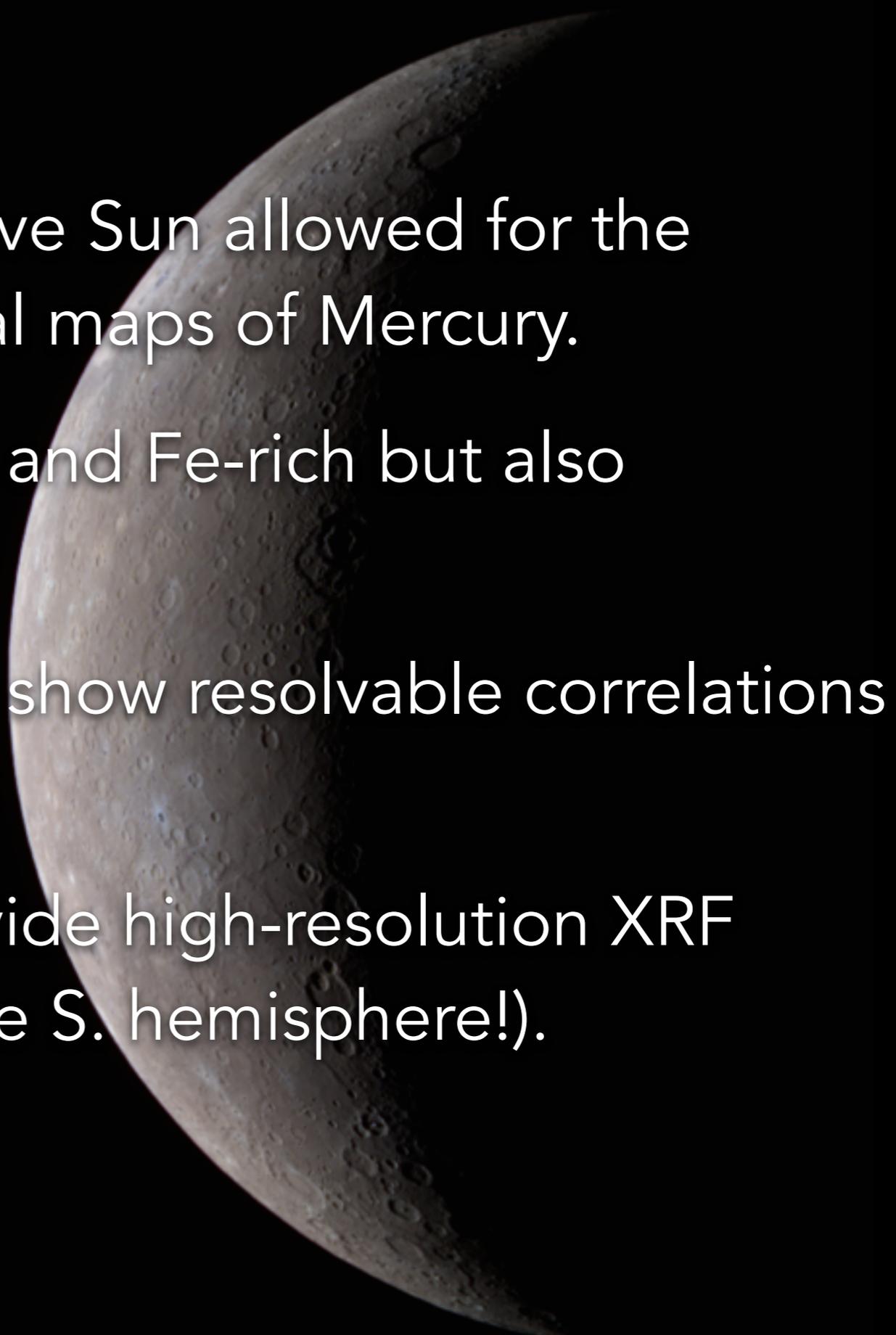
Mg/Si



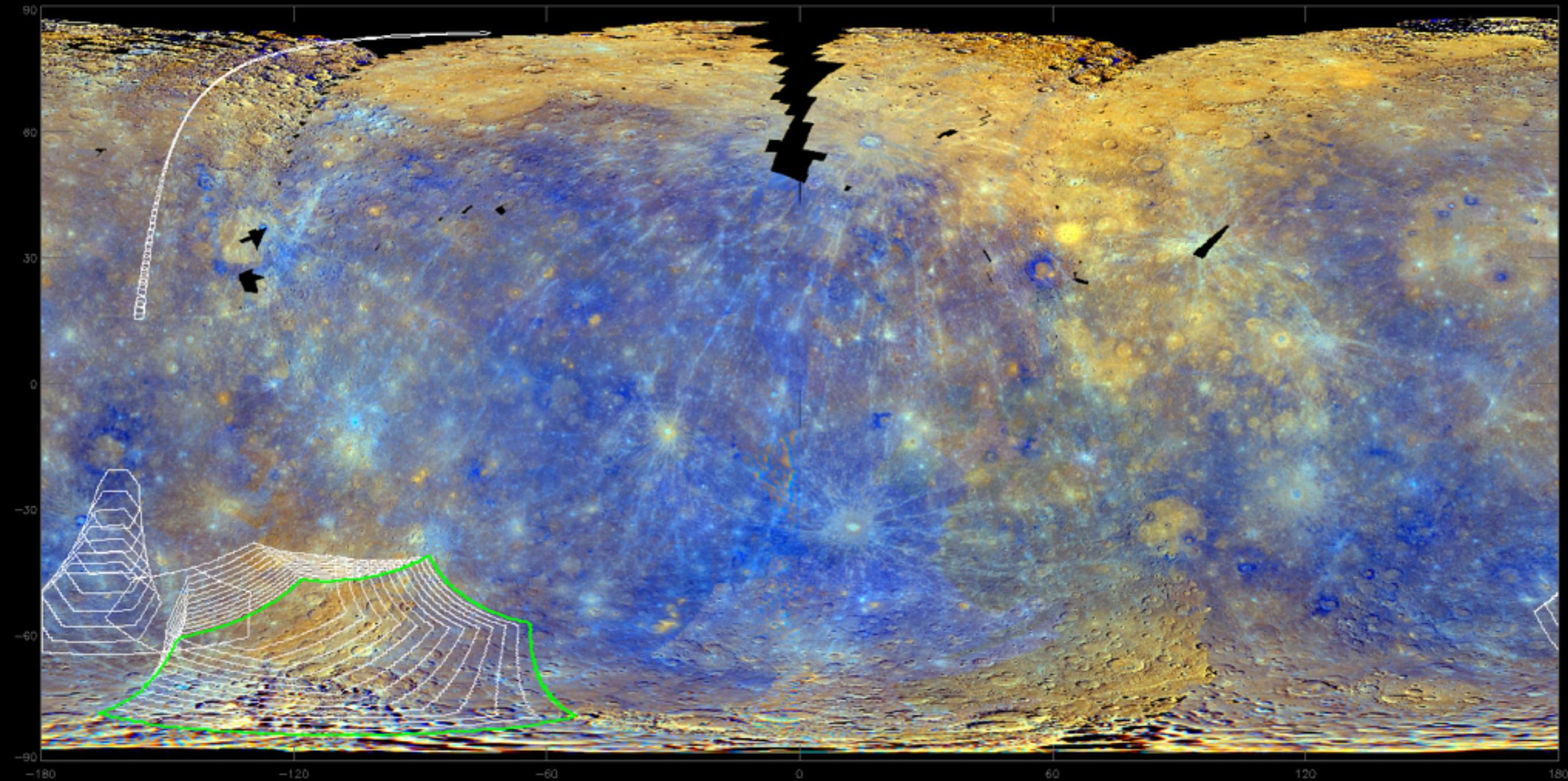
Features of interest: Fresh deposit near Gauguin Crater



Summary

- Low-altitude orbits and an active Sun allowed for the highest-resolution geochemical maps of Mercury.
 - The high-Mg region is S-, Ca-, and Fe-rich but also heterogeneous.
 - Small-footprint measurements show resolvable correlations with geologic features.
 - Future: BepiColombo will provide high-resolution XRF measurements (including of the S. hemisphere!).
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Footprints



weighting factor (w_i):

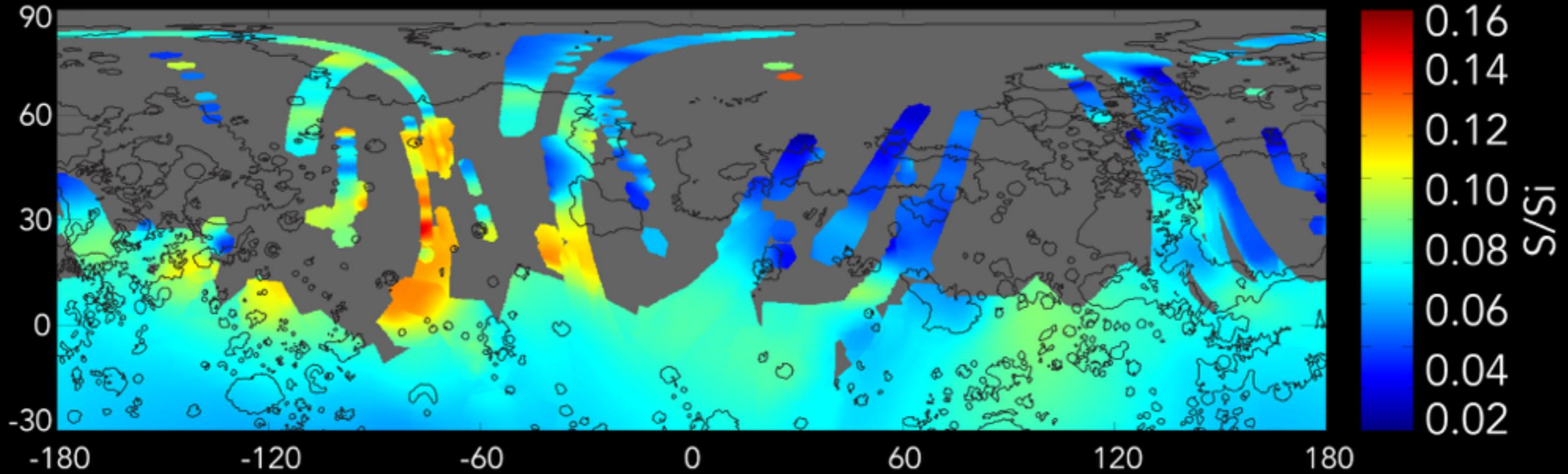
$$w_i = \frac{1}{A_i \times \sigma_i^2}$$

A_i = footprint area

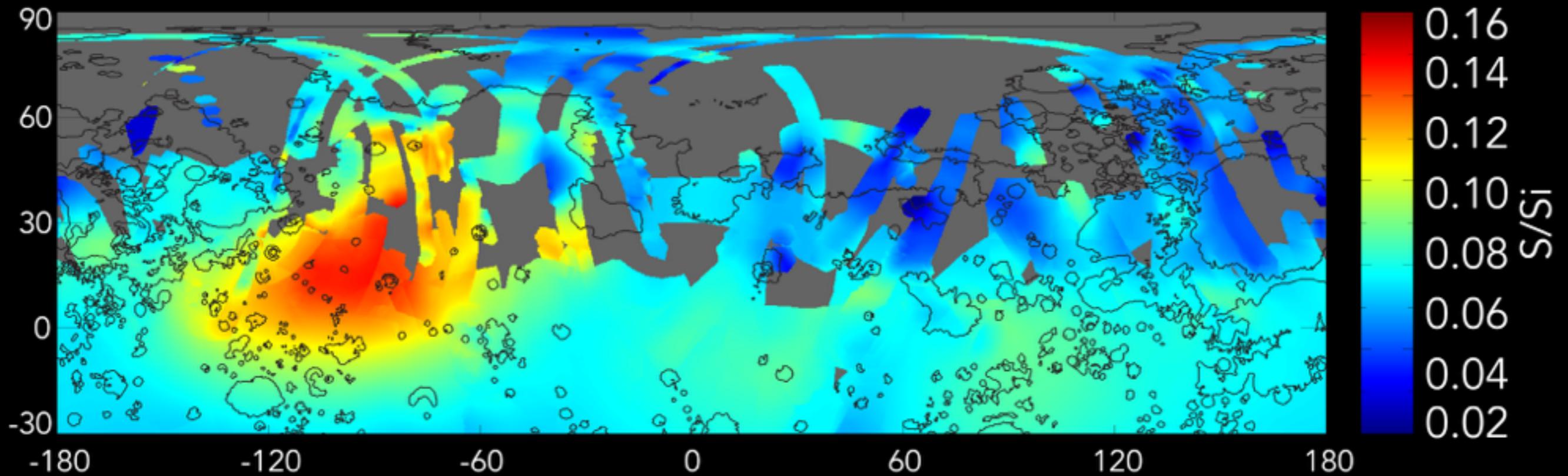
σ_i = error

Maps: S/Si

Previous: Weider et al. (2015)

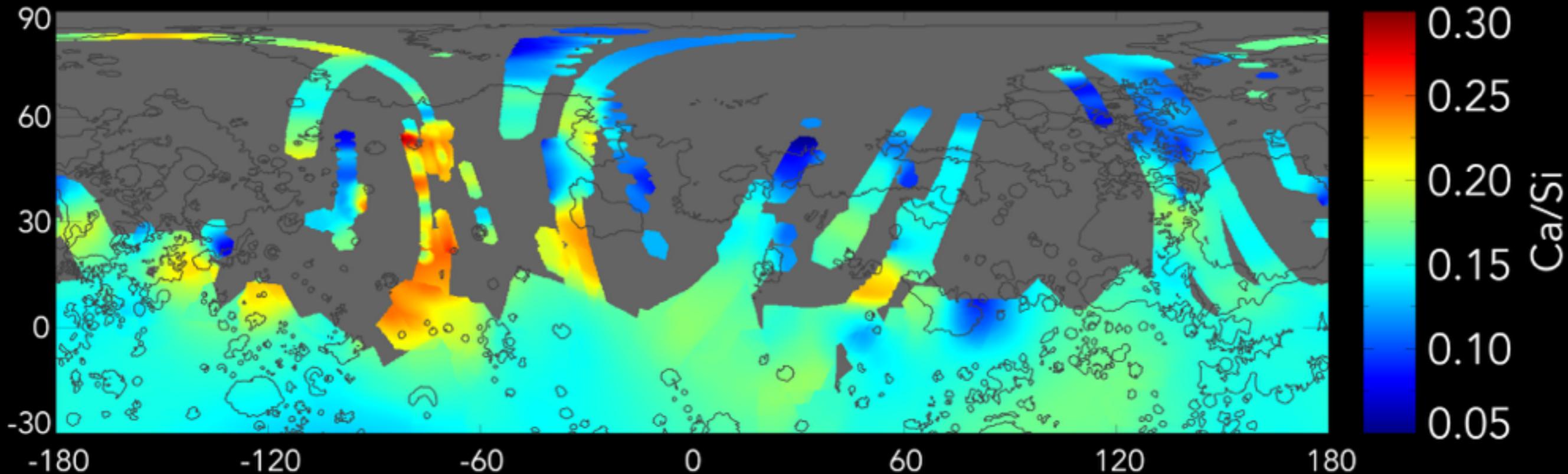


New

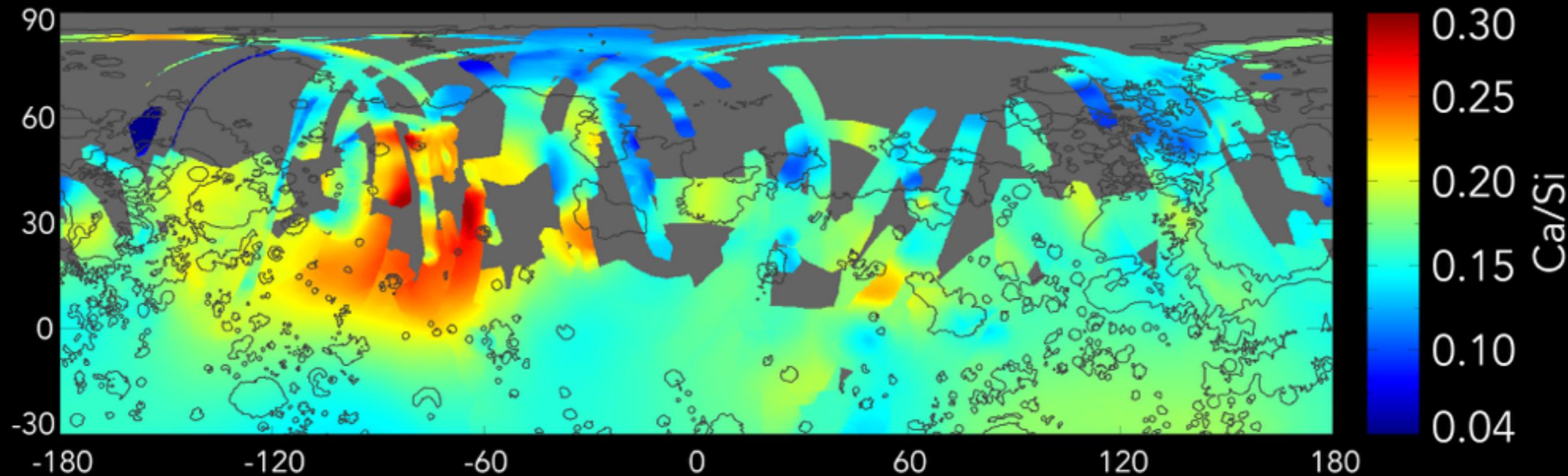


Maps: Ca/Si

Previous: Weider et al. (2015)

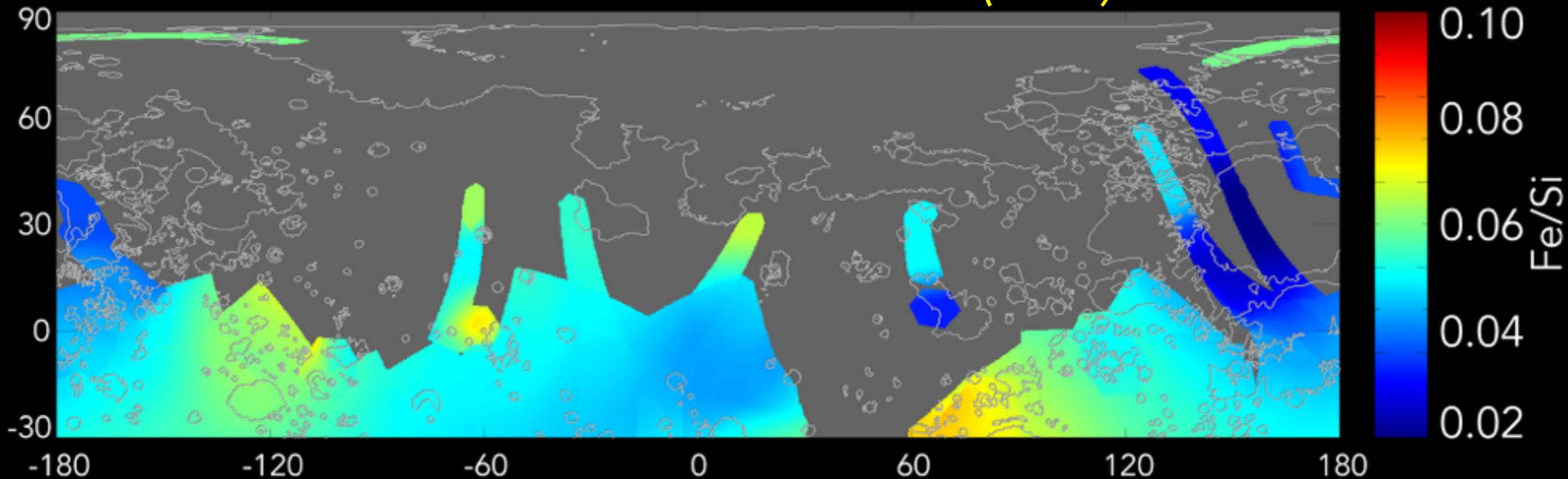


New

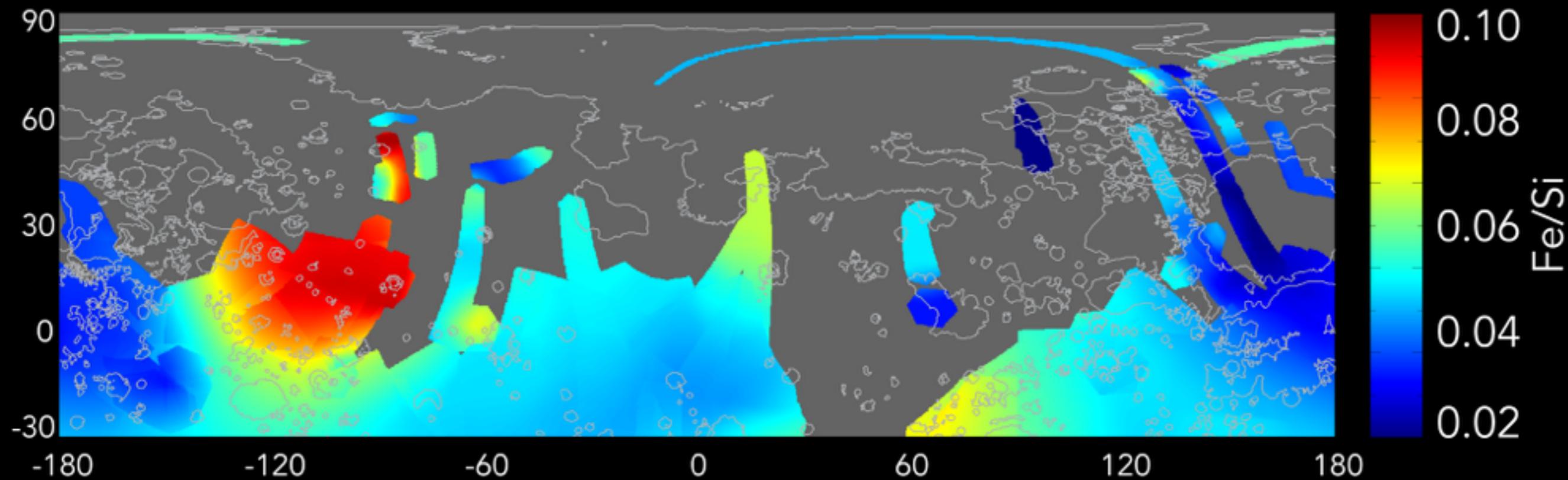


Maps: Fe/Si

Previous: Weider et al. (2015)



New



Maps: Fast neutrons (Lawrence et al. 2015, LPSC)

