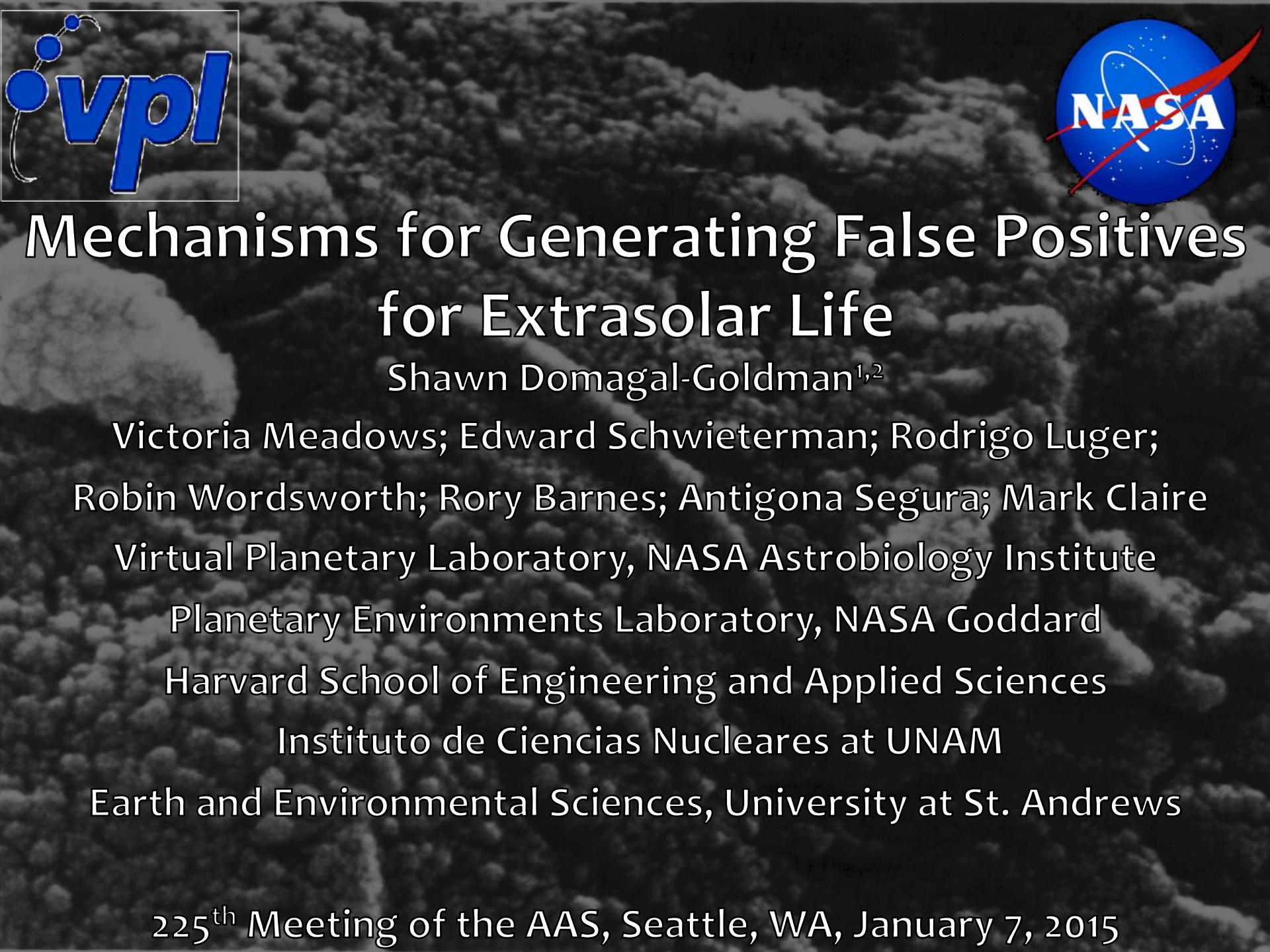

Mechanisms for Generating False Positives for Extrasolar Life

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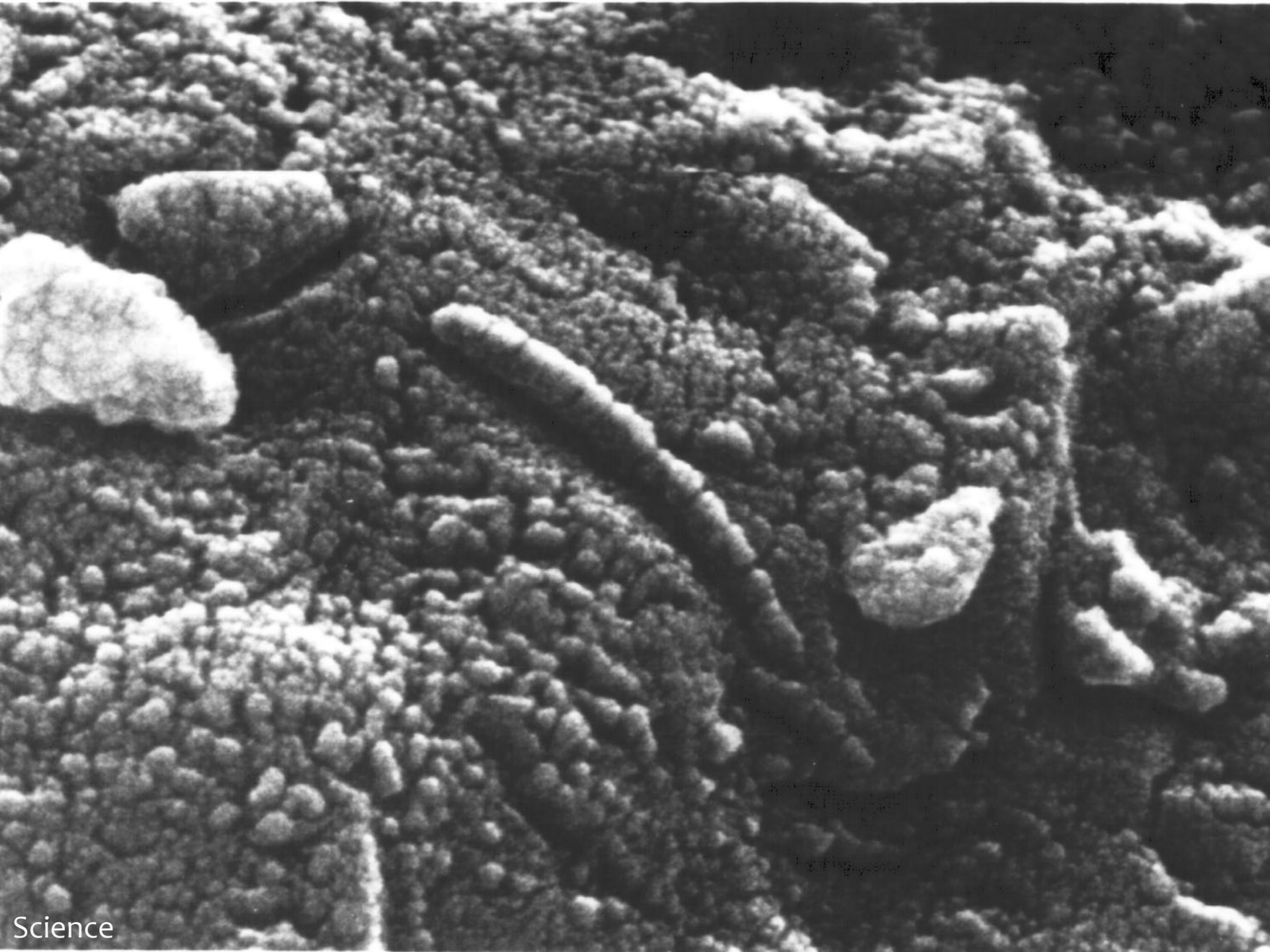
225th Meeting of the AAS, Seattle, WA, January 7, 2015



Science

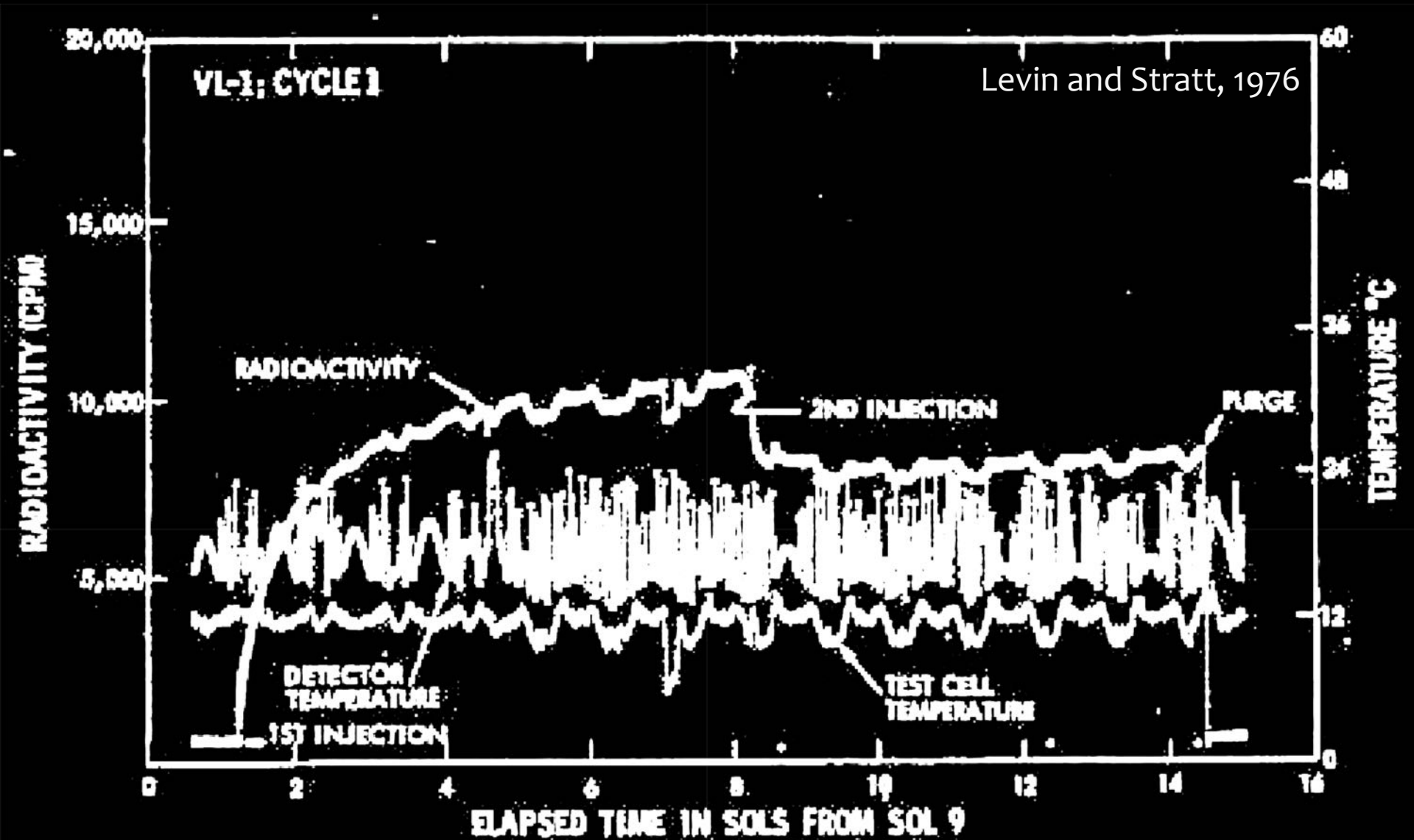
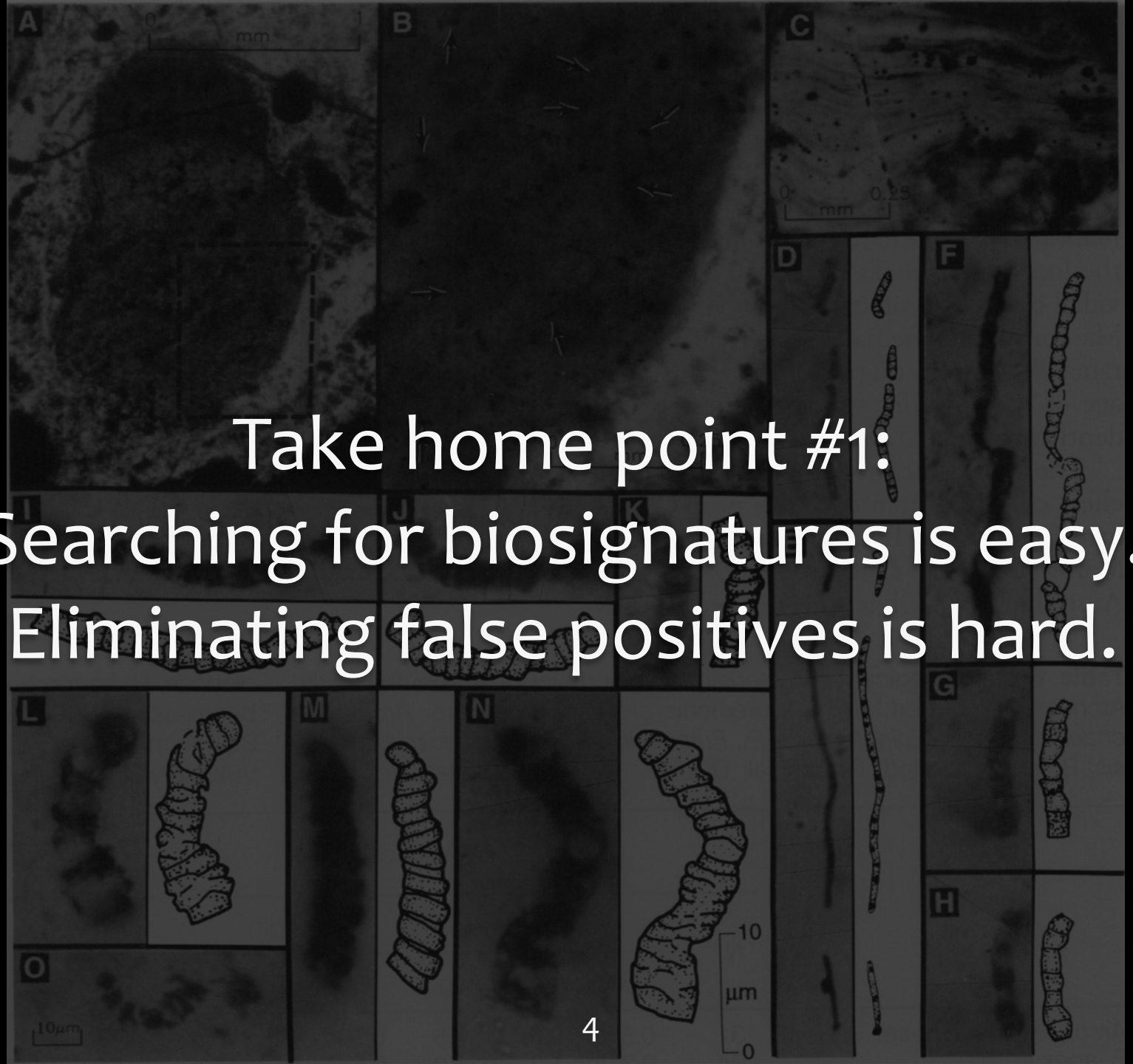
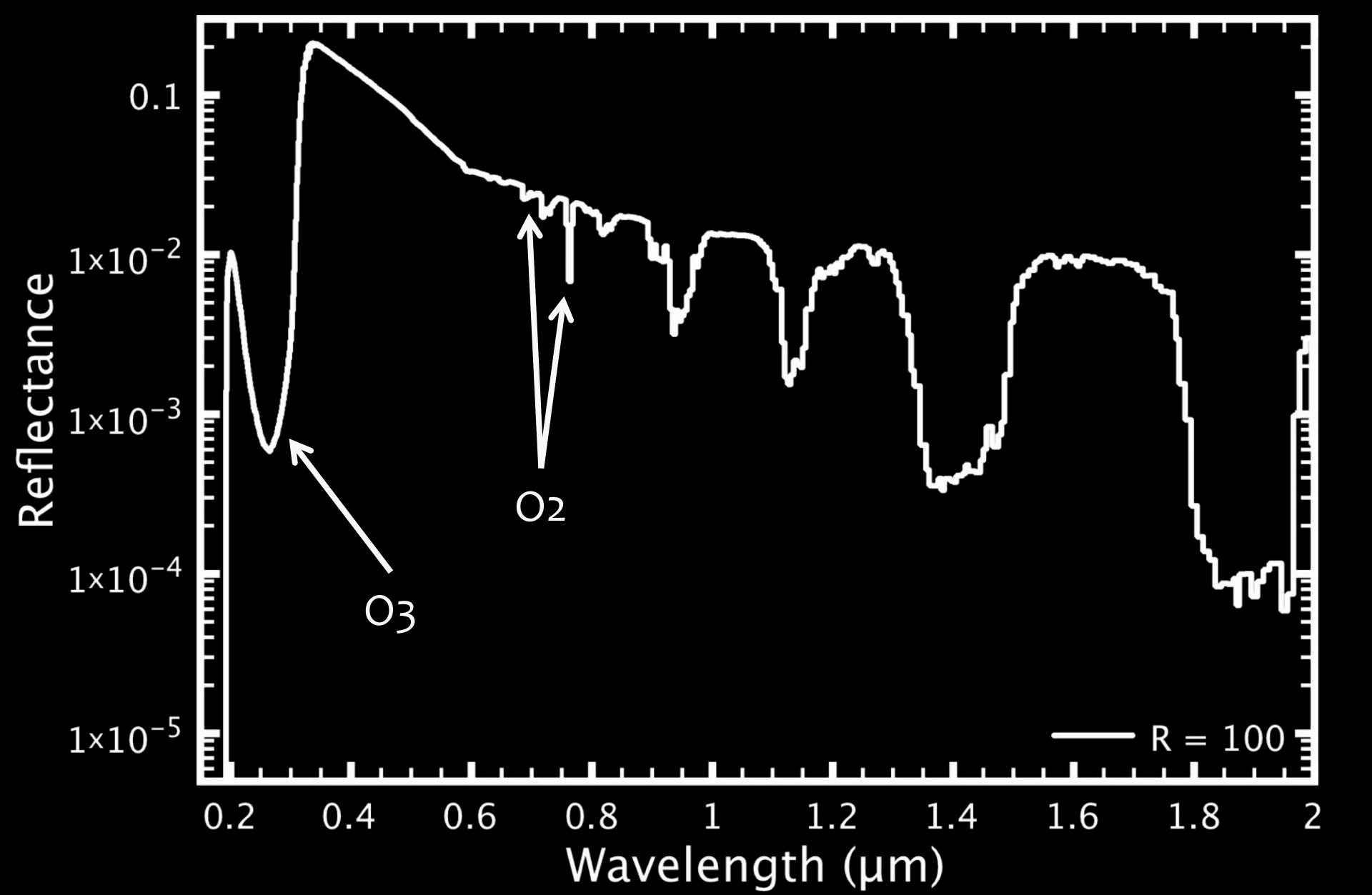


Fig. 1. Plot of LR data from first sample analysis on VL1. An active sequence was used on a fresh surface sample. Radioactivity was measured at 16-minute intervals throughout the cycle except for the first 2 hours after the first nutrient injection when readings were taken every 4 minutes. Radioactivity data include a background count of 490 cpm prior to the onset of the cycle. Detector and test cell temperatures were monitored every 16 minutes.

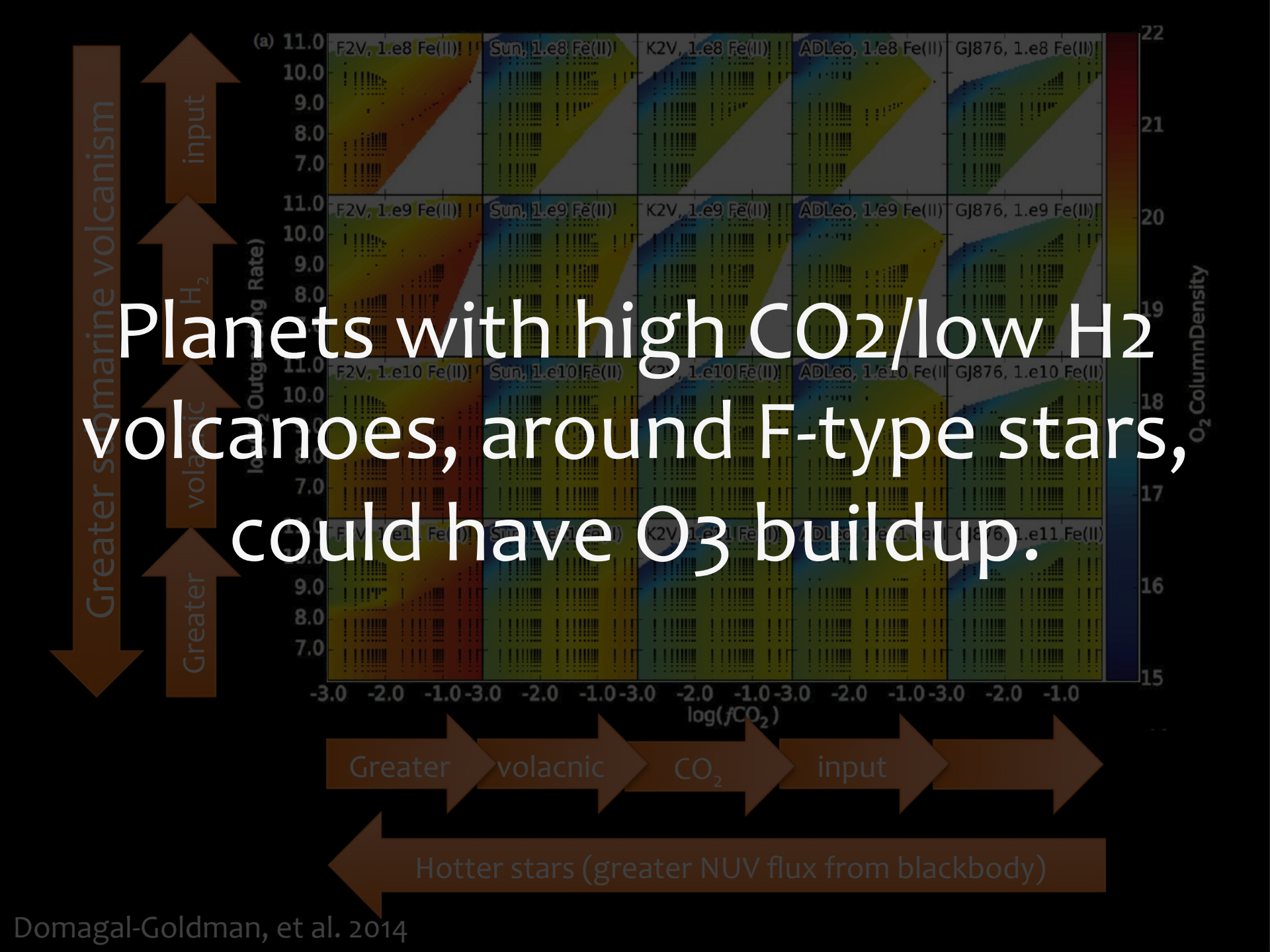


Take home point #1:
Searching for biosignatures is easy.
Eliminating false positives is hard.

Schopf, *Science*, 1993

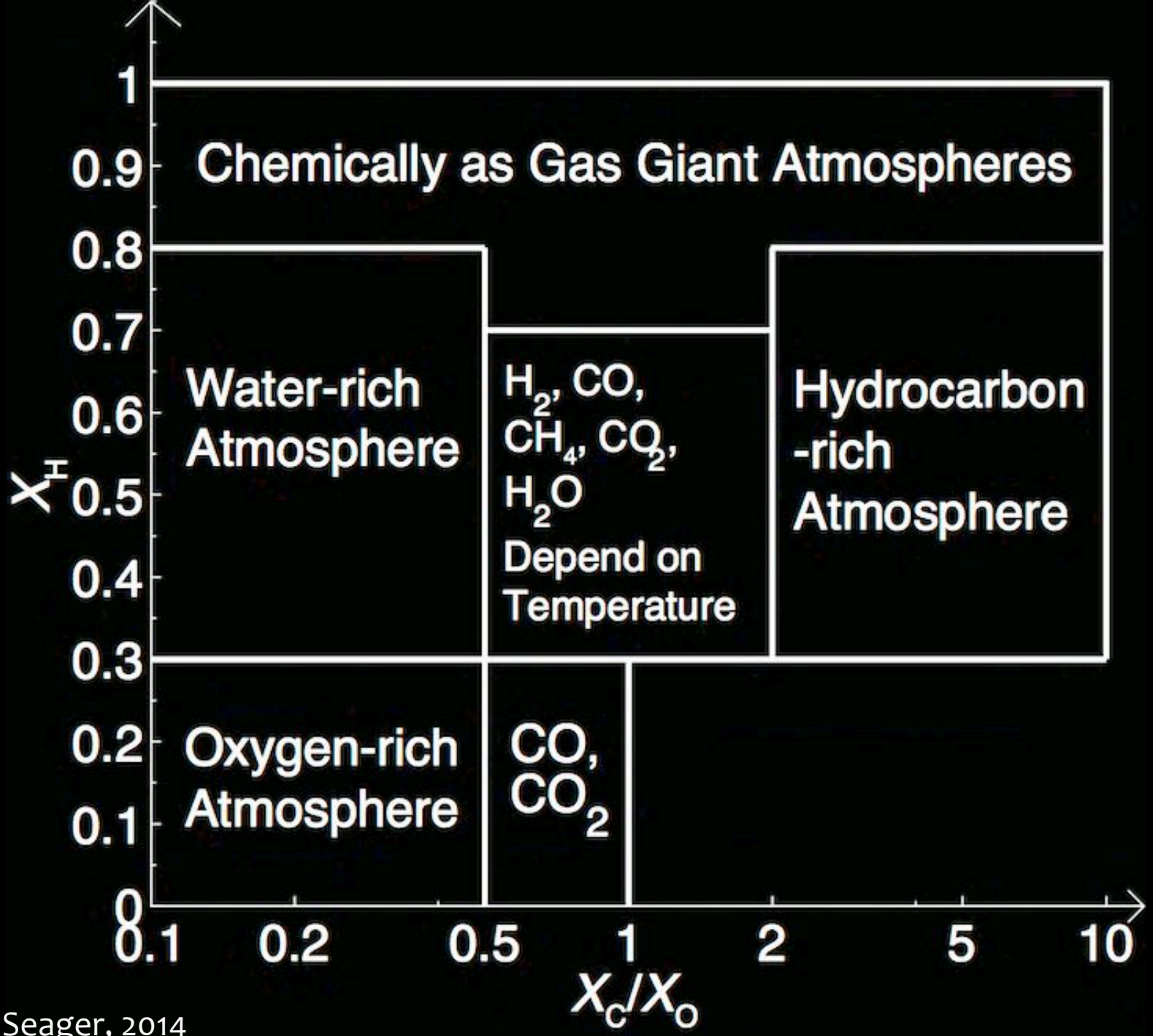


Robinson et al. 2011

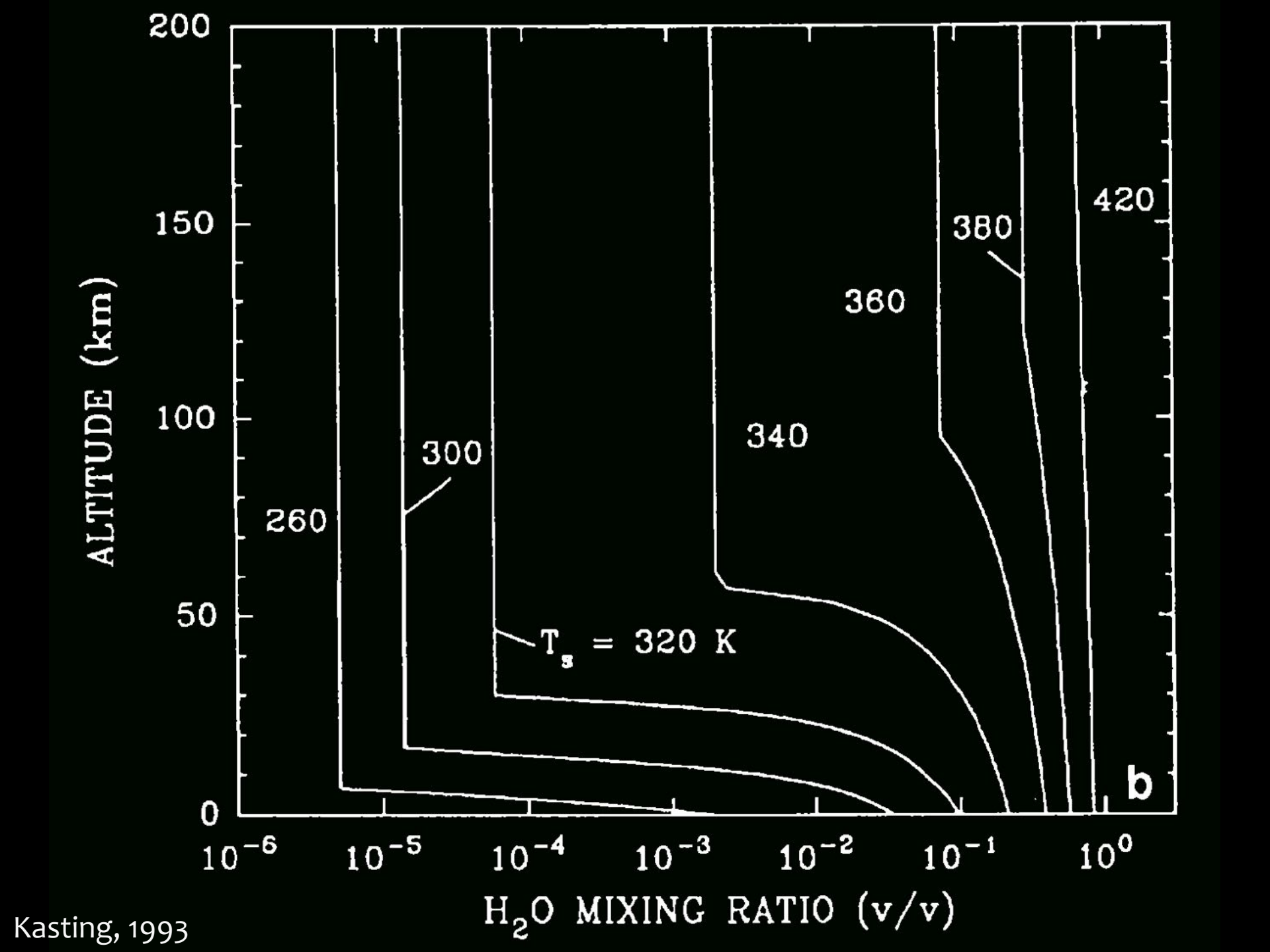


Planets with high CO2/low H2 volcanoes, around F-type stars, could have O3 buildup.

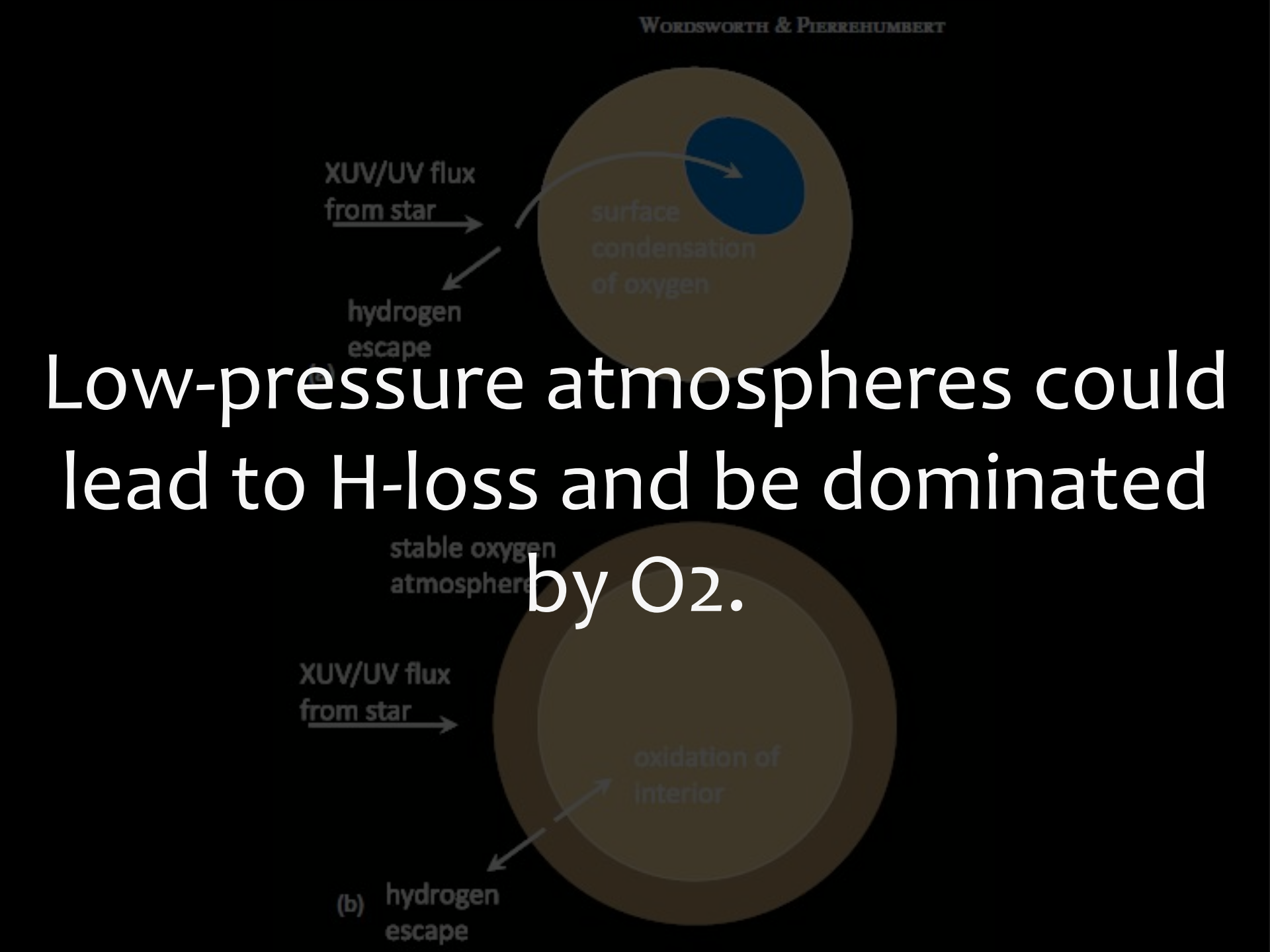
Domagal-Goldman, et al. 2014



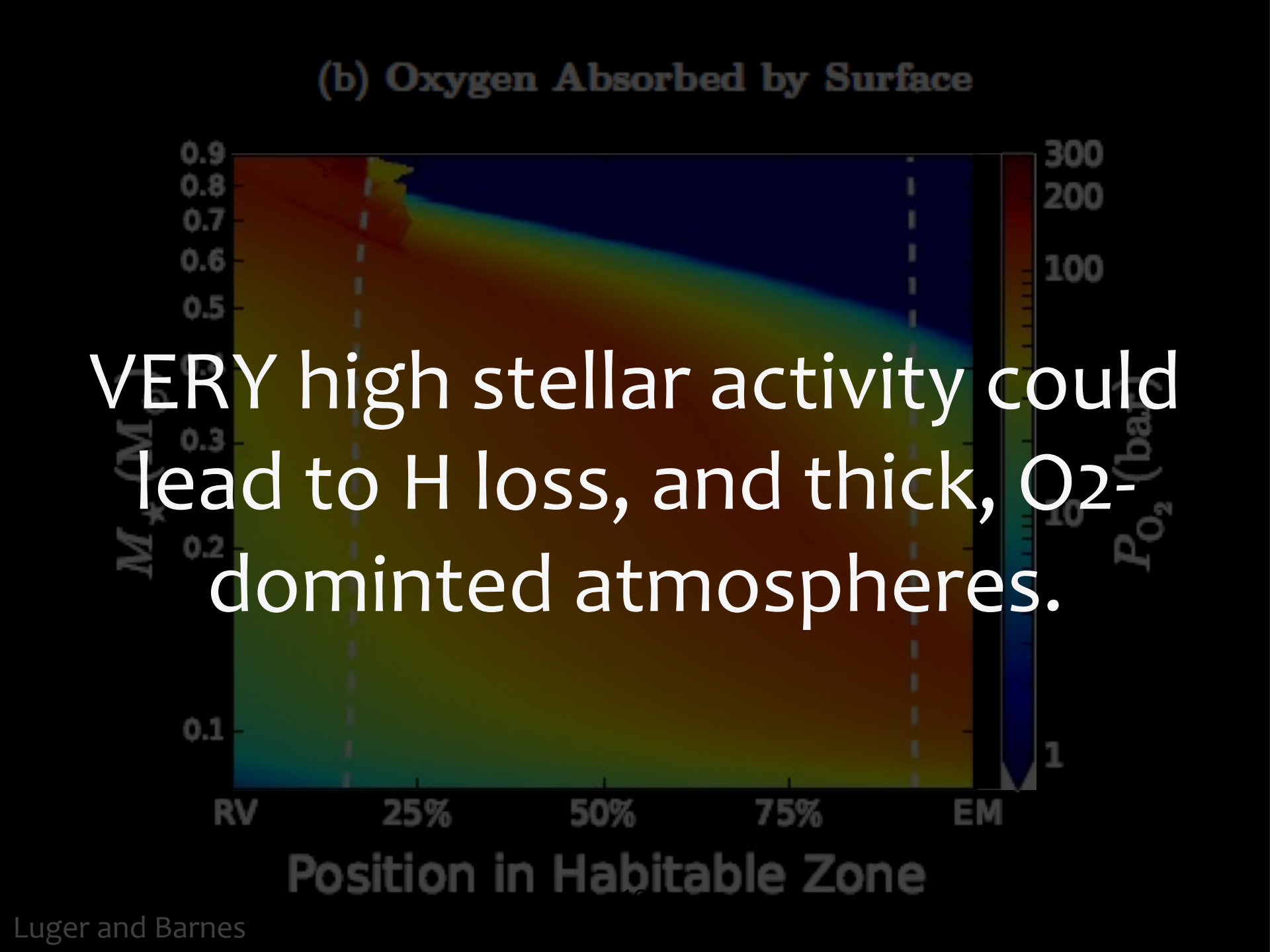
Hu and Seager, 2014



Kasting, 1993



Low-pressure atmospheres could lead to H-loss and be dominated by O2.



VERY high stellar activity could lead to H loss, and thick, O2-dominted atmospheres.

Luger and Barnes

Review

Finding biosignatures is (relatively) EASY!

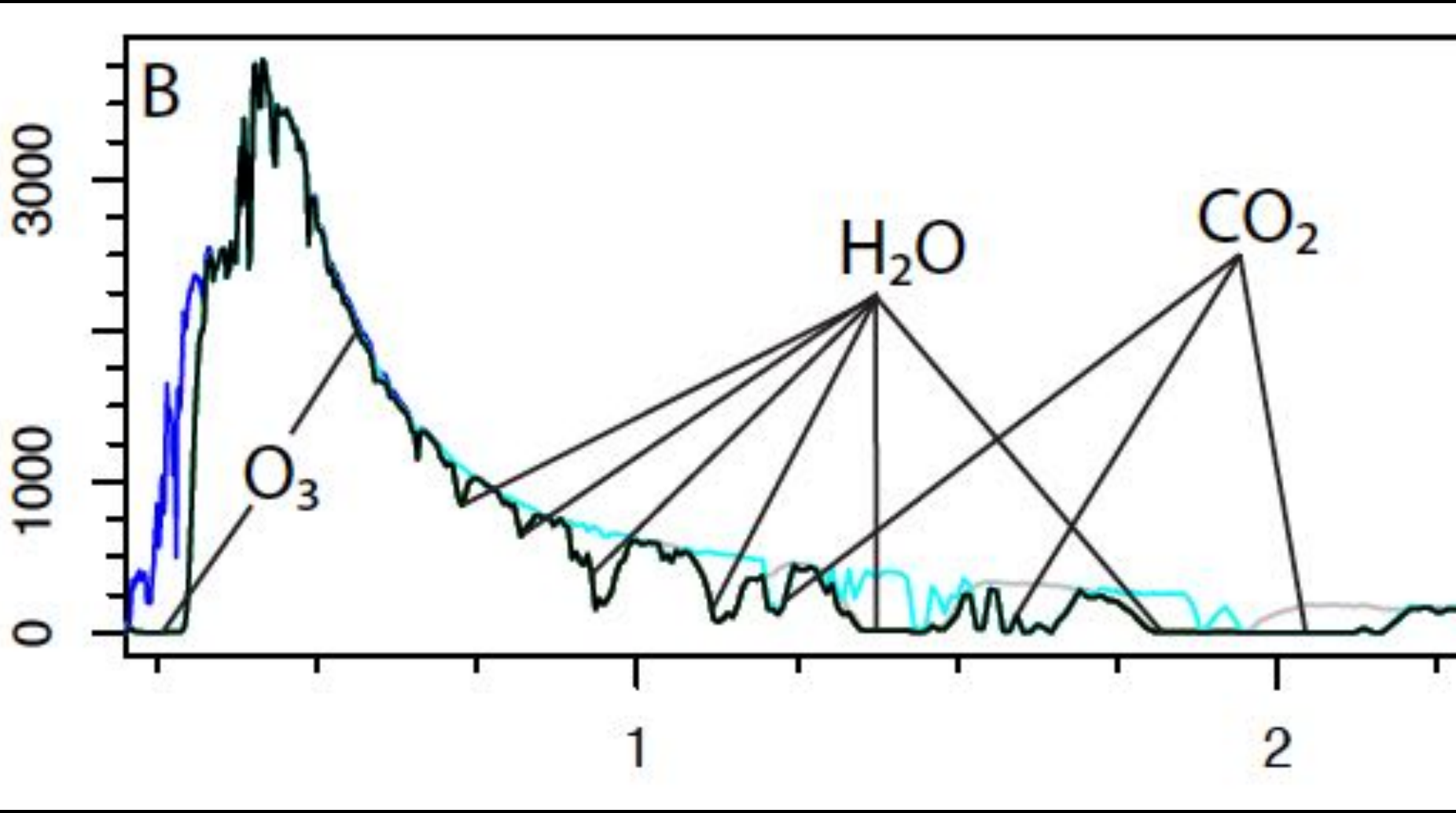
Confirming life as the source of these gases – and ruling out false positives is the HARD part.

CH_4 is the best discriminator…

Stellar spectra are also critical for all false positives.

For identifying photochemical false positives, we want to measure/constrain CO_2 and CO.

For identifying false positives from H-loss, we want to know the pressure of the atmosphere.



Domagal-Goldman et al., ApJ 2014