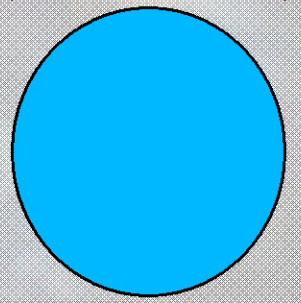
Oxigênio e o tamanho da vida

Linha do tempo

Tempo de oxigenação, 3,9 bilhões de anos

O_2 ~ 10-100% do valor atual

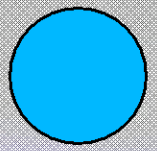
~ 1 cm



Possibilidade de circulação
Possibilidade de complexidade
Diversos níveis tróficos

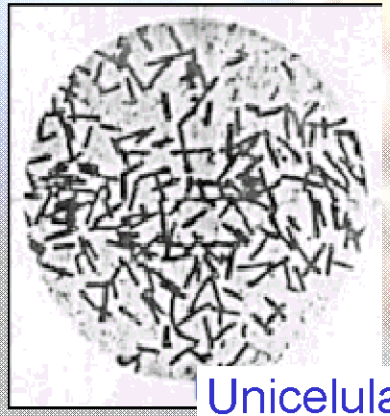
O_2 ~ 1% do valor atual

~ 1 mm



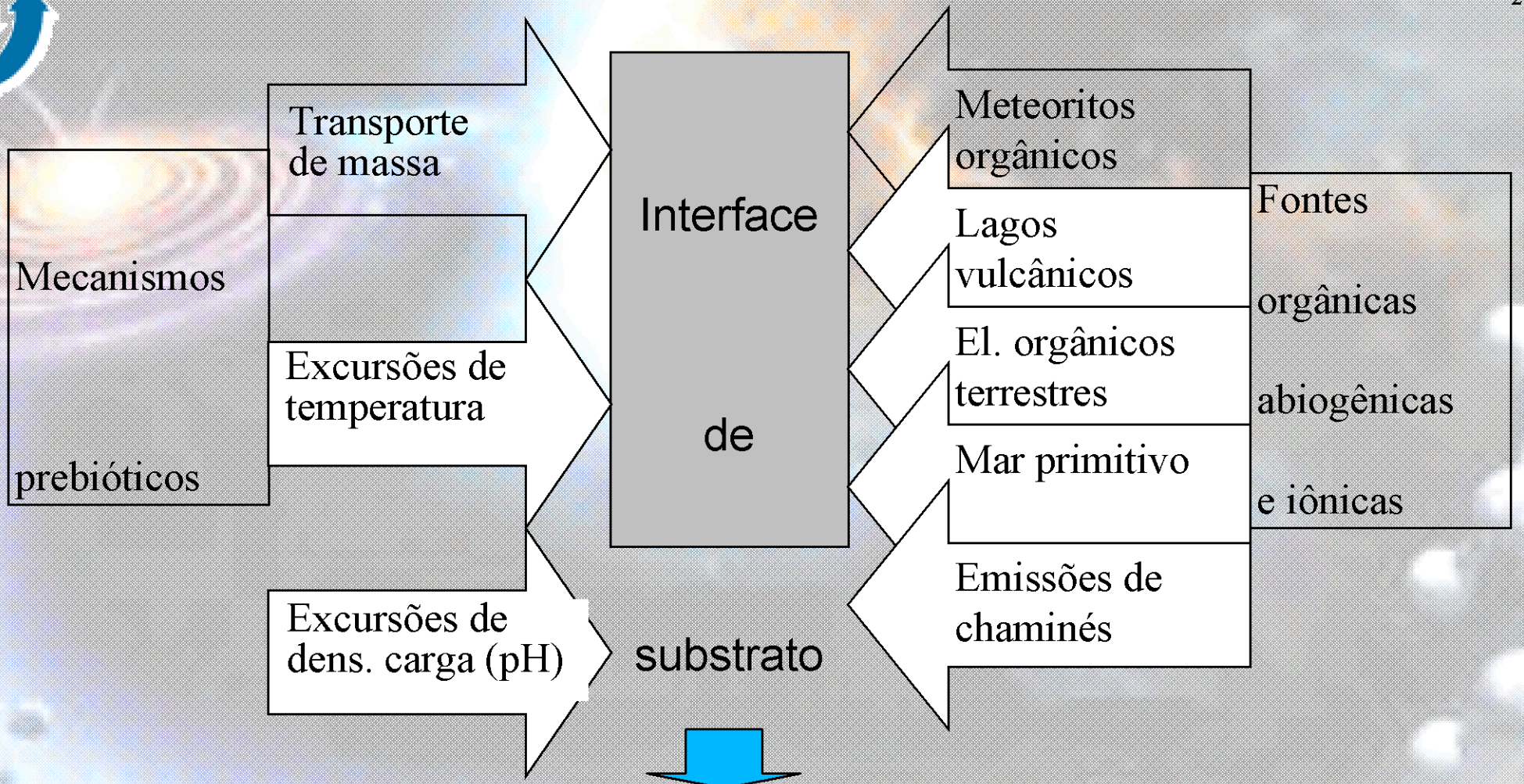
Tamanho limitado por difusão

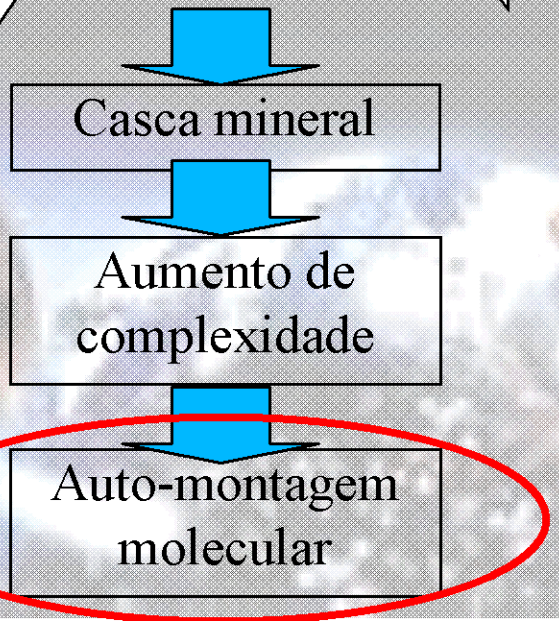
O_2 desprezível



Unicelulares

Adaptada de Catling (2006)





Adaptada de F. Souza-Barros, 2006

A BUSCA DE VIDA FORA DA TERRA

Carlos Alexandre Wuensche

Procurando vida...

- Não inteligente...
  - Busca de bio-traçadores no Sistema Solar.
  - Busca de planetas extra-solares.
  - Busca de bio-traçadores em planetas extra-solares.
- Inteligente...
  - Busca de sinais "não-naturais" vindos de outro local do Universo (SETI).

J. Tarter, Annual Review of Astronomy and Astrophysics (2001)

Nosso Sistema Solar...

- Vários locais no nosso Sistema Solar podem ter sido, ou ainda ser, favoráveis à vida.
  - Marte?
  - Europa?
  - Titã?
  - Encelado?

Marte: bastante explorado recentemente

- NASA
  - Mars Rovers: Spirit e Opportunity
  - Mars Global Surveyor/Mars Pathfinder (Sojourner)
- ESA
  - Mars Express: Beagle 2

Água em Marte?

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nature

LETTERS

Hydrated silicate minerals on Mars observed by the Mars Reconnaissance Orbiter CRISM instrument

John F. Mustard[1], S. L. Murchie[2], S. M. Pelkey[1], B. L. Ehlmann[1], R. E. Milliken[3], J. A. Grant[4], J.-P. Bibring[5], F. Poulet[5], J. Bishop[6], E. Noe Dobrea[3], L. Roach[1], F. Seelos[2], R. E. Arvidson[7], S. Wiseman[7], R. Green[3], C. Hash[8], D. Humm[2], E. Malaret[8], J. A. McGovern[2], K. Seelos[2], T. Clancy[9], R. Clark[10], D. Des Marais[6], N. Izenberg[2], A. Knudson[7], Y. Langevin[5], T. Martin[3], P. McGuire[7], R. Morris[11], M. Robinson[12], T. Roush[6], M. Smith[13], G. Swayze[9], H. Taylor[2], T. Titus[14] & M. Wolff[9]

Phyllosilicates, a class of hydrous mineral first definitively identified on Mars by the OMEGA (Observatoire pour la Mineralogie, L'Eau, les Glaces et l'Activitié) instrument[1,2], preserve a record of the interaction of water with rocks on Mars. Global mapping showed that phyllosilicates are widespread but are apparently restricted to ancient terrains and a relatively narrow range of mineralogy (Fe/Mg and Al smectite clays). This was interpreted to indicate that phyllosilicate formation occurred during the Noachian (the earliest geological era of Mars), and that the conditions necessary for phyllosilicate formation (moderate to high pH and high water activity[3]) were specific to surface environments during the earliest era of Mars's history[4]. Here we report results from the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM)[5] of phyllosilicate-rich regions. We expand the diversity of phyllosilicate mineralogy with the identification of kaolinite, chlorite and illite or muscovite, and a new class of hydrated silicate (hydrated silica). We observe diverse Fe/Mg-OH phyllosilicates and find that smectites such as nontronite and saponite are the most common, but chlorites are also present in some locations. Stratigraphic relationships in the Nili Fossae region show olivine-rich materials overlying phyllosilicate-bearing units, indicating the cessation of aqueous alteration before emplacement of the olivine-bearing unit. Hundreds of detections of Fe/Mg phyllosilicate in rims, ejecta and central peaks of craters in the southern highland Noachian cratered terrain indicate excavation of altered crust from depth. We also find phyllosilicate in sedimentary deposits clearly laid by water. These results point to a rich diversity of Noachian environments conducive to habitability.