Methane reservoirs on Mars: A story of migration, gas hydrates, traps, and a long production cycle

Gian Gabriele Ori and Goro Komatsu
IRSPS, Pescara, Italy

I am a geologist and I will provide a geological perspecive

The geological approch

Methane is produced in the subsurface by abiological or biological processes

Methane is accumulated in shallow reservoirs

Methane is released to the surface by degassing processes that leave evidence at the interface

Methane production: abiological

Methane can be produced in an abiological way by serpentinisation of the basalt

Basalt are present in the subsurface probably along with water

The massive production of basalts must be counteracted by crustal consumption

Serpentinisation is not quite efficient in producing methane but the long Martian history allows the formation of huge amount of gas

Methane production: biological

There is a wealth of bacterial communities in the deep and shallow subsurface of the Earth

Bacterial communities are methanogenic

Bacterial communities are the most probable form of life on Mars

They are stable and protect in the subsurface

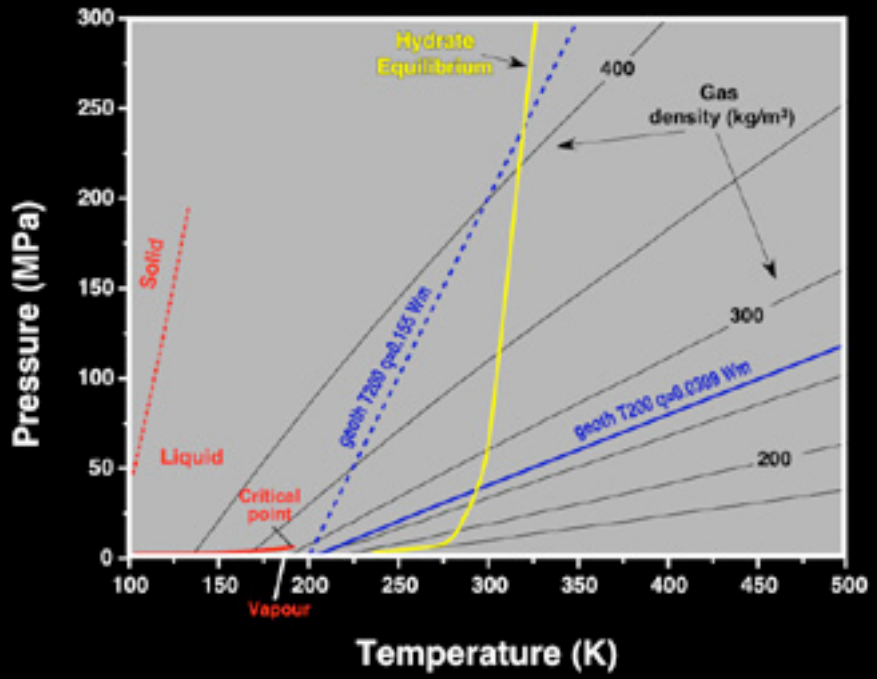
Methane storage in shallow subsurface

Methane can be concentrate in traps as both free gas and gas hydrates

Gas hydrates are stable in the very shallow subsurface

Bacterial communities are the most probable form of life on Mars

They are stable and protect in the subsurface



Phase diagram, hydrate stability and density of Methane and geothermal gradients

Degassing

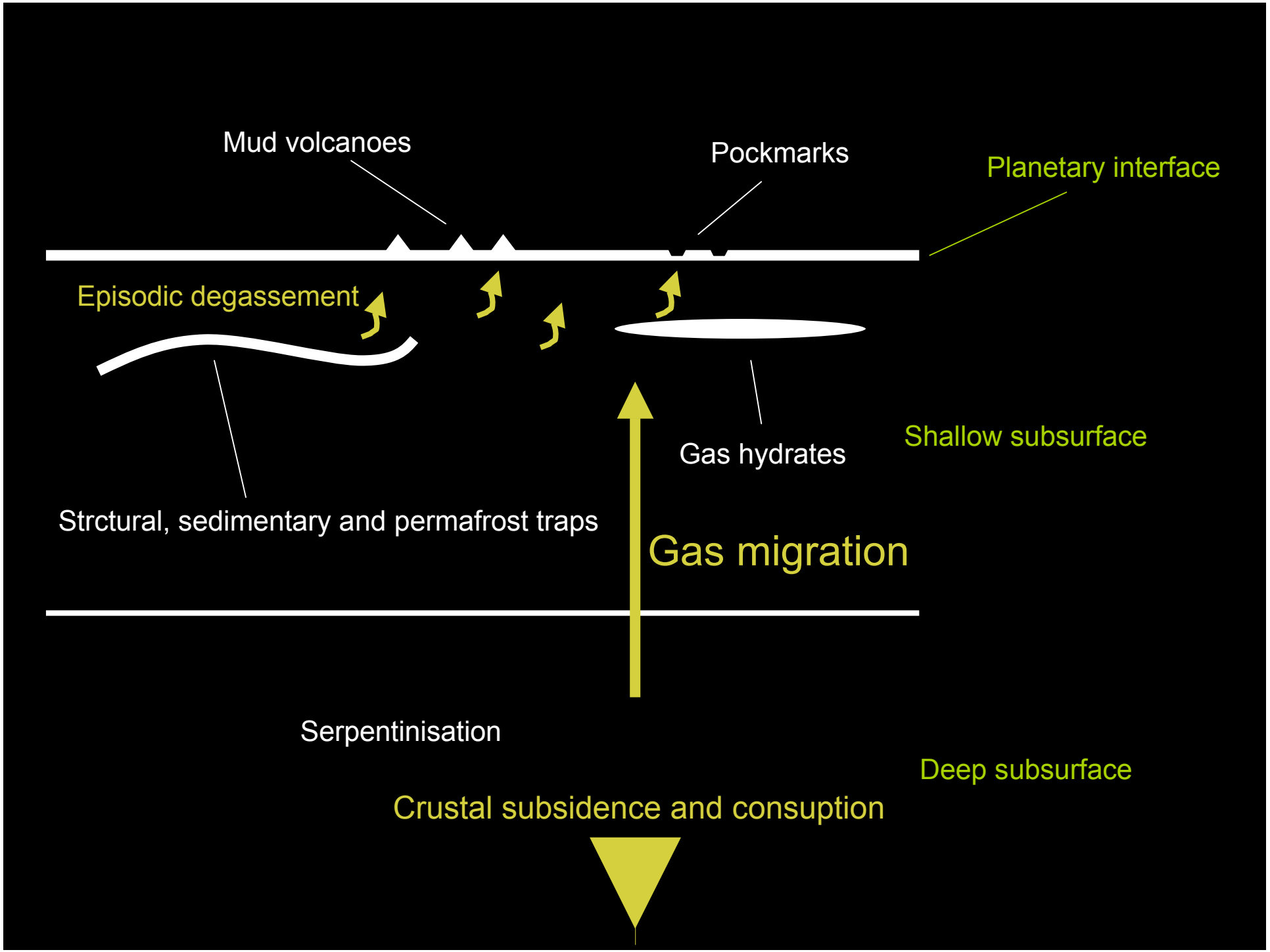
Episodically gas traps realesed loads of methane by:

- Tectonic movements
- Climatic changes
- Landslides and chaos formation
- Volcanic activities

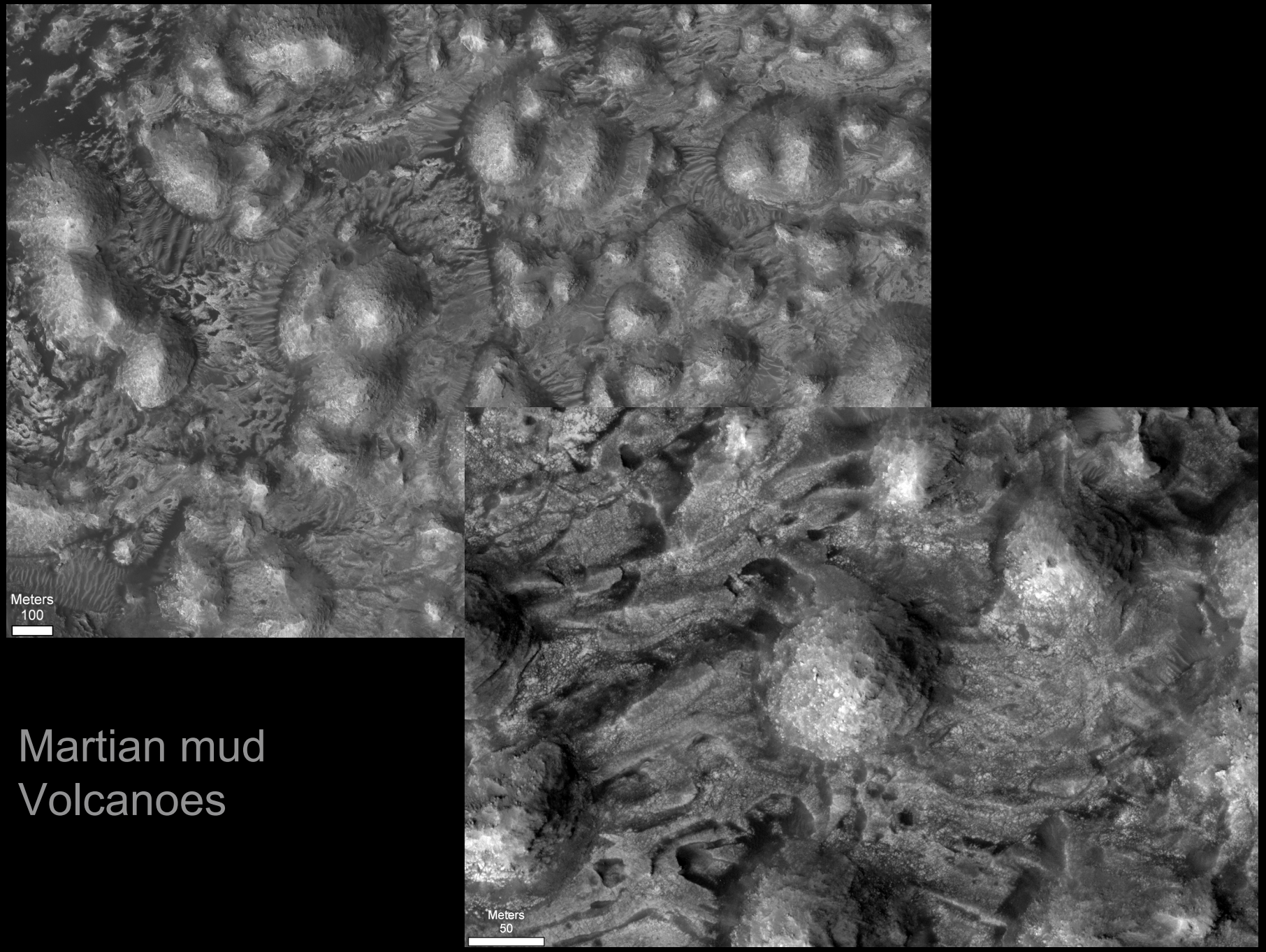
Methane is formed in the deep subsurface throughtout the entire geological history of the planet

Methane migrates in the shallow subsurface and trapped in tectonic or sedimentary reservoirs (including clathrates or permafrost)

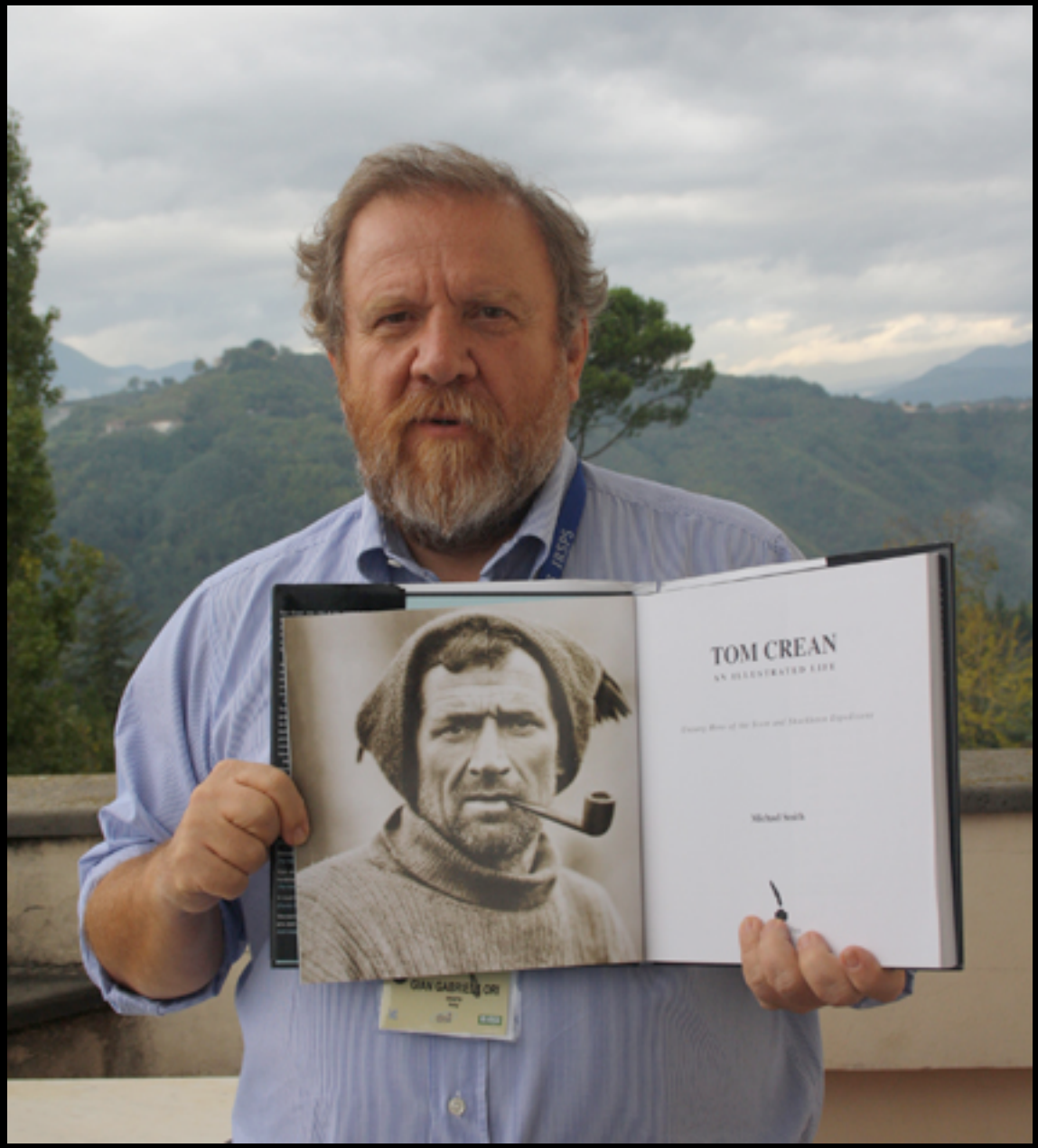
Methane is released into the atmosphere episodically during destabilising events


Mud volcanoes
Pockmarks
Planetary interface
Episodic degassement
Gas hydrates
Shallow subsurface
Strctural, sedimentary and permafrost traps
Gas migration
Serpentinisation
Deep subsurface
Crustal subsidence and consuption

Devonian mud volcanoes from Southern Morocco, Kess Kess Fm



Martian mud Volcanoes


TOM CREAN
AN ILLUSTRATED LIFE
Michael Smith