Life Sciences as Related to Space (F)
Chemical Evolution and the Origins of Life in the Solar System and Other Planetary Systems: Exo-, Astrobiological Aspects (F32)

STONE 6: MARS-ANALOGUE ARTIFICIAL SEDIMENTARY METEORITES IN SPACE

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Of the 34 meteorites from Mars, none are sedimentary although sediments exist in abundance on the planet. The STONE experiments aim at testing the survivability of different types of analogue martian sediments during entry into the Earth's atmosphere. The rocks are fixed into the heat shield of a FOTON re-entry vehicle around the ablation point and undergo entry speeds of about 7.6 km/s (meteorite entry speeds are slightly higher, at 12-15 km/s). Previous STONE experiments have proven the survivability of dolomite and sandstone through atmospheric passage (STONE 1 and STONE 5). The STONE 6 experiment included an Early Archaean chert (3.446 Ga) from the Pilbara containing cryptic traces of fossil life (microfossils, C isotopes) (N.B. this sample is a good sedimentary Noachian Mars analogue], a Devonian laminite (mudstone) from the Orkneys (Fig 1e), and an Eocene basalt from Austria. A culture of a modern endolithic microorganism, Chroococcidiopsis, was smeared on the back side and on the flanges of each of the rocks before flight. Despite 2 cm thickness of rock, the latter did not survive although their carbonized remains did. The two sedimentary rocks had severely ablated surfaces and have been affected by heat and shock metamorphism (devolatilisation). The 3.446 Ga-old microfossils appear to have survived in the part of the rock furthest from

the ablated edge. Thermal maturation of the carbon in both sediments occurred. It is clear that sedimentary martian rocks similar to those we used could survive atmospheric entry. We conclude that traces of martian life in Noachian sediments could reach Earth. Equally, traces of life in terrestrial meteorites, especially from the pre 3.5 Ga period for which we have no terrestrial record, could eventually be found on Mars.