A CONSTANT IDP FLUX BASED ON IRIDIUM ANALYSES OF ARCHEAN SEDIMENTS

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Introduction: In modern sediments, iridium (Ir) concentrations are inversely correlated to sedimentation rate because of the near constant flux of Ir-bearing interplanetary dust particles (IDPs) to the Earth's surface [1,2]. In order to calculate the sedimentation rate in ancient rocks using Ir, the IDP flux must be known. Previous studies [3] have reported low Ir levels in late Hadean/early Archean metasedimentary and metavolcanic rocks from Akilia, Greenland. They suggest that IDP mass accretion rates do not scale to the rate of supply, and that increasing abundance results in increasing collisional loss. Schmitz et al. [4] showed that Ordovician-aged sedimentary rocks record higher meteorite flux than modern sediments, but that the IDP flux, based on ^{3}He measurements, was comparable to that of today [5] unless there was significant loss of ^{3}He due to alteration. In this study, we systematically analyzed a section of 3.24 Ga core from the base of the Fig Tree Group in the Barberton greenstone belt (BGB) in South Africa for Ir. The lithology is fine carbonaceous chert and black and white banded chert. There is little coarse debris and the sediments lack evidence of current transport and deposition. These characteristics indicate that this is a condensed section formed at very low sedimentation rates.

Methods: A 4.8 m core was logged for lithology, sedimentary structures, and post-depositional features. It was sliced into 5 cm-long segments, from which a portion spanning the full length was powdered and thin sections were made. Ir was measured in each sample by RNAA and major and trace elements by XRF.

Results and Discussion: Ir concentrations in the 96 samples range from 2 to 663 pg/g, comparable to the range of concentrations found in modern sediments, suggesting that IDP flux in the Archean must have may not been significantly different than the Phanerozoic mass flux. More than 85% of the Ir concentrations are less than 200 pg/g, and likely reflect IDP accumulation rates, but several samples had Ir >200 pg/g, including two spikes >600 pg/g. These could represent extraterrestrial "events" such as impacts or increases in IDP flux. Sedimentation rates in various rocks throughout the BGB have been estimated to range from 10 to 1000 m/Myr, consistent with estimates in this study (averaging 80 m/Myr) if IDP flux is the same as modern rates. Rates higher than this are unlikely as they would have resulted in suppression of microbial mat formation and extraordinarily thick rock successions even assuming large breaks in time. Such high rates of sedimentation are also unlikely given that the sediments were deposited in a quiescent marine setting. Very high levels of Ir in the underlying S3 impact layer and lower background levels seen here suggest that though large impacts would have introduced significant amounts of Ir to the Earth's surface, the flux from dust is unchanged compared to today.

References: [1] Barker & Anders 1968. *Geochimica et Cosmochimica Acta* 32:627-645. [2] Bruns P. et al. 1996. *J. of Sed. Res.* 66:608-612. [3] Anbar et al. 2001. *J. of Geophysical Res.* 106:3219-3236. [4] Schmitz B. et al. 1996. *Earth and Planetary Science Letters* 145:31-48. [5] Patterson et al., 1998 ibid 163: 315-325.