Clumped isotope depositional temperatures from Palaeoproterozoic fine-agglutinated and microdigitate stromatolites: ~1.9 Ga Vempalle Formation, Cuddapah Basin, India

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The ~1.9 Ga [1] Vempalle Formation of the Cuddapah Basin, southern India, contains peritidal carbonates with well-preserved diverse stromatolites. Here we report stable isotope and clumped isotope analyses of three different morphotypes of Vempalle stromatolite from the Kadri-Pullivendla road section: Type I (thickly layered, domal), Type II (finely layered, columnar), Type III (microdigitate). The resemblance of fabrics of Type II stromatolites to ~1.4 Ga examples in North China [2], suggests that these Vempalle examples may be the oldest confirmed fine-agglutinated stromatolites currently known. We analysed $\delta^{13}C_{VPDB}$ and $\delta^{18}O_{VPDB}$ in dolomitic carbonates and isolated organic matter for the $\delta^{13}C_{org}$. Our results show that Type I, II and III are indistinguishable in terms of $\delta^{13}C_{VPDB}$ and $\delta^{18}O_{VPDB}$. However, $\delta^{13}C_{org}$ values range from -26‰ to 23.9‰. Clumped isotopic analysis of Type I indicates a temperature of 66°C and corresponding water $\delta^{18}O_{water}$ -1.56‰, Type II indicates 96°C and $\delta^{18}O_{water}$ 2.93‰, and Type III 70°C and $\delta^{18}O_{water}$ -0.42‰.