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# Hydrothermal energy transfer and contribution to autotrophic CO$_2$ fixation down sediment core in Central Indian Basin

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Hydrothermal Energy Transfer is not only restricted to active vents sites but also to the passive ones. These passive sources could include the sub-seafloor hydrothermal fluid flux derived from distant sources like erupting vents or from deep-mantle. The contribution from such fluxes in stimulating autotrophic carbon fixation could be measurable. In this paper an attempt is made to measure the autotrophic $CO_2$ fixation down a siliceous sediment core (Core 20, 75$^?$30'E, 12$^?$S) adjoining Trace of Rodrigues Triple Junction in the Central Indian Basin (CIB) with a fluid flux influence at 15-20 cms bsf (below sea-floor) which is quite distinct from the pelagic influence on the overlying 0-15 cms bsf. This work assumes that $NH_4^+$and $S^{2-}$ are major $e^-$donors/reductants to fuel C-Fixation. The down-core carbon fixation varied from 0.032-0.122$\mu$mol C $g^{-1}$day$^{-1}$ with the larger peak at 15-20 cms bsf. This coincides with the dips in pore-water concentrations of $NH_4^+$ and $S^{2-}$. Therefore the corresponding standard free energy change ($\Delta G^?$') down-core varied from -97 at 4-6 cms bsf to -375 J $\mu$mol$^{-1}$ C fixed $m^{-3}$ day$^{-1}$ at 12-14 cms bsf in case of $NH_4^+$. In case of $S^{2-}$ the values varied from -42 at 4-6 cms bsf to -162 J $\mu$mol$^{-1}$ $m^{-3}$ day$^{-1}$at 12-14 cms bsf. Integrated down-core estimate of $\Delta G^?$' is calculated to be -26.97 J $\mu$mol$^{-1}$ C fixation $m^{-2}$ day$^{-1}$ during $CO_2$ fixation using $NH_4^+$ and -11.7 J $\mu$mol$^{-1}$ C fixation $m^{-2}$ day$^{-1}$ using $S^{2-}$. This fluid-flow influenced layer appears physically as a brown-green transition zone in the core at a depth of 15-20 cm bsf. Interestingly similar observations have been made in $>$15 such cores around the present test core. These observations suggest that this spreading bed at this depth could be due to the upward fluid flow that then spreads laterally. This spread could perhaps be more than the area that the current observations permit. So the Hydrothermal Energy Transfer is equivalent to -11.70 to -26.97 J $\mu$mol$^{-1}$ C fixation $m^{-2}$ day$^{-1}$and corresponds to 88 $\mu$mol of $CO_2$ fixation $m^{-2}$day$^{-1}$ through $NH_4^+$ and $S^{2-}$ respectively. Given the assumption that this diffuse process is not limited to the availability of light or focused vent flow the contribution may perhaps be much larger than projected as the reach in space and time could be much higher than the present projection.