New production measurements in the Bay of Bengal

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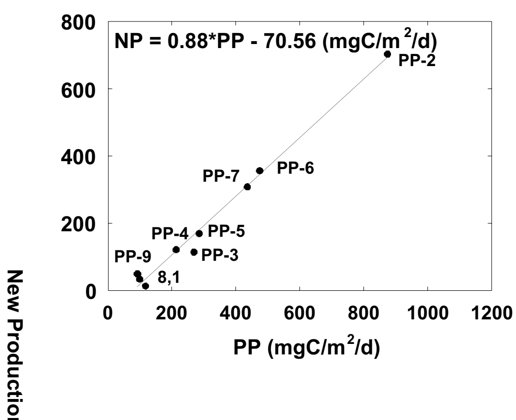
We report here the first ever measurements of ^{15}N based productivity (cf. Dugdale and Goering, 1967) and the f- ratios for Bay of Bengal (BOB) during Sep.-Oct. 2002, measured onboard ORV Sagar Kanya. JGOFS protocol was followed and samples were analyzed for nitrogen isotopes using a Finnigan Delta Plus isotope ratio mass spectrometer. The error in PON measurement was found to be around 10% and error in ^{15}N atom% measurement was less than 1% in the case of nitrate and urea while 3.5% in the case of Ammonia. The precision for the $\delta^{15}N$ measurement in the standard (IAEA-NO-3, KNO_3) was found to be ± 0.64‰ (1σ) for n = 19. The total production (nitrate + ammonia + urea) varied from 1 to 11 mg-at-Nm^{-2}day^{-1}. Euphotic zone integrated nitrate-induced productivity ranged from 0.16 to 8.8 mg-at Nm^{-2}day^{-1}, while ammonium uptake rates lie in the range 0.28 to 0.81 mg-at Nm^{-2}day^{-1}. Urea uptake rates were from 0.25 to 1.32 mg-at Nm^{-2}day^{-1} .The total production reported here is higher than equivalent carbon fixation reported for BOB during July-August of 2001 (Prasanna Kumar et al., 2002). This could be due to reduced stratification caused by poorer summer monsoon in 2002. There was a significant correlation between new and total production (Fig). It appears that the Bay of Bengal can be at least half as productive as the Arabian Sea in years of poorer monsoon.



Isotopic study of the groundwater at Horonobe, northern Hokkaido, Japan

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Introduction

The Japan Nuclear Cycle Development Institute (JNC) is undertaking geological investigations in Horonobe Town, northern Hokkaido. The main aim is to develop a generic methodology that could be used in future, to characterize sedimentary rock sites elsewhere that may be selected for the geological disposal of high-level radioactive wastes.

The studied area is about 3km square and surrounds the planned underground research laboratory (URL) site. Four boreholes (HDB-1, 3, 4, 5) in this area intersect Pliocene diatomaceous argillaceous rocks of the Koitoi and Wakkanai formations. A fault, the Ohmagari fault, may cross the middle of the area and control groundwater flow there. HDB-1, 3 and HDB-4, 5 lie to the west and east of the fault respectively.

Studies of carbon, oxygen, and hydrogen isotopes are being conducted to develop a method for estimating groundwater residence times or ‘ages’.

Methods

Activities of ^{14}C and ratios of stable oxygen ($^{18}O/^{16}O$) and hydrogen (D/H) isotopes were measured in pumped groundwater and porewater samples. Radiocarbon was measured by AMS (NEC 15SDH-2) and stable isotopes were determined by Micromass OPTIMA mass spectrometer. To facilitate estimations of groundwater contamination by drilling fluid, a fluorescent dye (sodium-naphthionate) was added to the drilling fluid to give a concentration of 10mg/l. The dye’s concentration and the electrical conductivity and pH of the water were monitored during the hydraulic tests.

Result and Conclusion

Electrical conductivities of samples from HDB-1 (490 m below Sea Level, mbSL), HDB-3 (122 mbSL), HDB-4 (226 mbSL), and HDB-5 (88 mbSL,) are about 2500, 3500, 430 and 40 mS/m respectively. The waters are all Na-Cl dominated, except for the HDB-5 water, which is Na-HCO_3 dominated. Relatively high salinities occur at relatively shallow depth in HDB-3. One possibility is that the Ohmagari Fault affects groundwater flow and the distribution of groundwater salinity in this area. The stable isotopic data suggest that an additional cause of salinity variations may be a variable component of ^{18}O-enriched (>+0.5 ‰ SMOW) water. The ^{14}C activities are very small (ca. 1-5 pMC) in samples from HDB-1, 3 and 4, but high (ca. 22 pMC) in the one from HDB-5. Possibly, the HDB-5 water had a relatively short residence time. Relationships between groundwater chemistry and inferred residence times will be discussed.