An experimental study on the autotrophic denitrification with sulphur electron donor in groundwater

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An understanding rate of nitrate removed in groundwater is vital for groundwater risk management associated with nitrate pollution, and to safeguard groundwater supplies and groundwater-dependent surface waters. In order to provide nitrate pollution bioremediation in groundwater with technical data by means of the autotrophic denitrification reaction nature, sulfur-contaminated soil sample from near a coal pile in Hefei city was collected. *Thiobacillus denitrificans* were isolated and incubated from the soil in enrichment culture medium ($Na_2S_2O_3 \cdot 5H_2O$ 5.0g, K_2HPO_4 2.0g, KNO_3 2.0g, $NaHCO_3$ 1.0 g, $MgSO_4 \cdot 7H_2O$ 0.6g, NH_4Cl 0.5g, $FeSO_4 \cdot 7H_2O$ 0.01g, in 1000 ml of deionized water, pH7.0-7.6) at 28℃ for 5 days, which was used to remove nitrate from groundwater with sulfur as electron donor, and adding some $CaCO_3$ to adjust alkalinity under anaerobic condition. The results show that: (1) The concentration of NO_3^--N was decreased to the value less than 10 mg/L at the hydraulic residence time (HRT) of 15 d, while the initial nitrate concentration was 100 mg/L, keeping S/N quality ratio of 3 (for $S_2O_3^{2-}$ to NO_3^-) and the initial turbidity at 660 nm of the culture after inoculation was adjusted to 0.10. (2) In general, the initial concentration of NO_3^-N has a negative effect on the rate of NO_3^-N removed. The optimal initial concentration of NO_3^-N is 40 mg/L with 75.5% removal rate. (3) Under the invariable HRT, completely denitrification dealing with the highest nitrate concentration is relate to sulfur grain diameter, the smaller the sulfur grain diameter, the larger the maximum volumetric loading rate of NO_3^-N, and the main component of the tail gas is nitrogen. The results provide new experimental supporting for the nitrate contamination remediation in groundwater and protecting the groundwater-dependent surface waters.

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Compilations of cratonic peridotite xenoliths: Constraints on continental lithospheric mantle compositions

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Low temperature Kaapvaal and some Siberian xenoliths from kimberlite are characterized by opx-enrichment coupled with high Mg# olivine, and have been accepted as typical feature of Archaean cratonic mantle. Keleman *et al*. [1] suggest that opx-rich mantle with high Mg# olivine could be produced by reaction between SiO_2-rich liquids (e.g. small degree melts of subducted eclogite) and previously depleted, low-opx peridotites. The later could be formed by Archean mantle melting to the exhaustion of orthopyroxene [2]. In this work, data of peridotite xenoliths from the worldwide major continents were compiled to investigate the distribution of mantle xenoliths with opx-enrichment coupled with high-Mg# olivine and evaluate the refertilization of depleted Archaean mantle by SiO_2-rich melt percolation. The database indicates that, (1) although 'Archean' mantles are generally not opx-rich, mantle with oilvine Fo>92 and opx-rich peridotite is almost exclusively Archean, (2) xenoliths from Greenland are generally characterized by high-Mg# olivine and opx-rich trend, (3) some xenoliths from Siberian craton show also opx-enrichment coupled with high Mg# olivine, (4) some xenoliths from Slave craton show high Mg# olivine, but cpx-enrichment, (5) slight opx-enrichment coupled with high Mg# olivine are also observed in a few Wyoming and Tanzania xenoliths, (6) xenoliths from Australia and North China show generally low Mg# olivine.

[1] Bernstein, Kelemen & Hanghøj (2007) Consistent olivine Mg# in cratonic mantle reflects Archean mantle melting to the exhaustion of orthopyroxene. *Geology* **35**(5), 459–462. [2] Kelemen P.B. Hart S.R. & Bernstein S. (1998) Silica enrichment in the continental upper mantle via melt/rock reaction. *Earth & Planetary Science Letters* **164**(1-2), 387–406.