Japan Geoscience Union Meeting 2014
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Upgradation of silica rich fluvial sands of Bangladesh: Proposals for alternate uses

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Major rivers of Bangladesh are carrying billions of tons of sediments from the Himalayan mountain range from the north, forming bars almost on every river. These bars inundate in floodwater every year, eroding some sediments as well as depositing more. Thus, almost all the rivers are getting filled with the sediment in course of time. The government of Bangladesh has undertaken a mega plan for Capital Dredging, for raising navigability of the main and important rivers across the country. But there is not enough space to keep those dredged materials. Hence, most of the time, the dredged materials are thrown only in the vicinity of dredging area. In course of very short time, those materials eventually return back to river bed with the precipitation and surface runoff. This makes wastage of time and money.

The river sediments are rich in silicate mineral, mainly quartz and feldspar, along with others, like heavy and micaceous minerals. Quartz (SiO_2) is the raw material for glass production. River sands of Bangladesh also contain some heavy minerals like magnetite, ilmenite, rutile, zircon, garnet, leucoxene, pyroxene etc., and some Mica group minerals like muscovite, biotite, chlorite etc. Industrial use of these minerals are widely accepted. Upgradation of river silica by some physical separation procedures like density, magnetic and electric separators, and chemical composition revealed from X-ray fluorescence analysis shows that 60-70% silica of river sediment can be easily enriched up to 94%. Very low amount of Fe, Al, Ca, Mg and absence of Cr and Ti indicates the probable use of this upgraded silica as glass producing sand.

For industrial use, advance research is necessary for potential use of such silica for silicon extraction or other silicon products e.g. silicon chip, if the upgradation can be reached more than 99%. The heavy and magnetic minerals associated with silica also can be used economically as by-products of the process. Mining of this sediment from the rivers will increase the navigability of the rivers. As dredging is a must in almost every river of Bangladesh, the mining will work as alternative work of dredging, saving huge amount of money to be spent for dredging. This will also lessen the risk of dangerous flood problem of the country.

Moreover, since fluvial sands has been used as earth filling materials for long time and is suitable in many technical aspects, potentiality of using such sediments for artificial islands can be thought. Japan has been implementing several artificial islands where materials like solid waste, soil from mountains are mostly used as filling materials which are not always environment friendly. Feasibility study for using bulk fluvial sand from Bangladesh as earth filling materials for future artificial islands of Japan can a better alternative. This will decrease the risk of potential environmental hazards that can be created from solid waste or hill-cutting. Use of dredged materials from Bangladesh will help decreasing environmental hazards like floods too. Economical sustainability can be achieved through such reduction of hazard risk.

キーワード: Fluvial Sand, Bangladesh, Silica, Heavy Minerals, Capital Dredging, Artificial Islands
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南アフリカ共和国カラハリマンガン鉱床の鉄同位体組成
Iron isotopic composition of the Palaeoproterozoic Hotazel Formation in the Kalahari Manganese Field, South Africa

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南アフリカの古原生代 Transvaal 累層群 Hotazel 層にあるカラハリマンガン鉱床は、縞状鉄鉱床に三つのマンガンに富んだ層が挟在する世界最大の層状マンガン鉱床である。Hotazel 層のマンガン鉱床および縞状鉄鉱床は、地球の大気中酸素が爆発的に増加した大酸化イベントとほぼ同時期に形成された。また、その形成年代からヒューロニアン氷河期のスノーボールアース事変との関連も示唆されている。鉄同位体は酸化還元状態の敏感な指標であり、縞状鉄鉱床形成時の海洋環境を推定するために適している。Hotazel 層の縞状鉄鉱床およびマンガン鉱床における鉄同位体分析に関する先行研究としては Tsikos et al. (2010) による報告があるが、縞状鉄鉱床の鉄同位体について十分なデータが集まったとは言い難い。

本研究では、南アフリカ共和国カラハリマンガン鉱床で採取されたドリルコアに対し、XRD 分析及び MC-ICP-MS を用いた鉄同位体分析を行い、その結果を Tsikos et al. (2010) と比較した。鉄同位体の測定は標準試料 IRMM-14 に対する δ56Fe 値で行った。

同位体測定の結果、Hotazel 層全体を通して低い δ56Fe 値 (-0.70 ‰以下) が得られた。マンガンに富んだ層に限れば、δ56Fe 値は-1.66 から-2.86 ‰と特に低い値となった。δ56Fe 値と鉄マンガン比との関係から、マンガンの存在比率が上がるに連れて δ56Fe 値が低くなる傾向にあることが確認された。この結果は、Tsikos et al. (2010) の結果と調和的である。つまり、縞状鉄鉱床が重い鉄同位体のシンクとしての役割をもっており、マンガンの沈殿は軽い鉄同位体に富む海洋環境で起きたとする Tsikos らの説を支持するものである。

Reference

Harilaos Tsikos, Alan Matthews, Yigal Erel, John M. Moore, 2010. Iron isotopes constrain biogeochemical redox cycling of iron and manganese in a Palaeoproterozoic stratified basin. Earth and Planetary Science Letters 298, 125-134. doi: 10.1016/j.epsl.2010.07.032

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