Ground Water Contamination of Arsenic in Ganges Plain

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Bangladesh stands on one of the largest deltaic plains of the world formed by the Ganges (Padma), Brahmaputra (Jamuna) and Meghna Rivers, and the huge lowlands have frequently suffered flooding due to cyclones and monsoons. But at the same time the plain carries fertile soils (detritus) transported by these rivers, which provides a good seat for cultivation of rice crops.

The arsenic contamination of groundwater here, however, is a severe environmental problem and several millions of people are reported to be affected by chemical toxicity from drinking water. The Samta village of Jessore district was chosen as a pilot station for the research of As contamination and to provide help for prevention of As diseases by AAN (Asian Arsenic Network) through NGO activity. This area is one of the worst affected by As contamination, arsenic contents of most tube wells exceed the toxicity limit set for this region (0.05mg/L). Geological and geochemical study of soils and sediments has been carried out to determine arsenic concentration. The results of the analyses showed 20 ppm for mud samples, and less than 10 ppm for sands. The sediments are transported by the Ganges and Brahmaputra Rivers, which originate from the Himalayas and their compositions are similar to the average value of sediments derived from continents. This suggests that specific source material of arsenic is difficult to correlate the provenance, such as mining areas especially of sulfide minerals, or hot springs.

Noteworthy is the discovery of peats in muddy layer in Deuli village east of Samta villages, which contain As in the level of 50-262 ppm. Sulfur concentration over 1.0 wt% is common in the peat, suggesting deposition under marine conditions. Anomalously higher concentration of arsenic is suggestive of origin of arsenic into groundwater from the peat and organic mud. In contrast to these contaminated areas, little or no contamination has been reported from some other areas in Bangladesh. The Mymensingh district is an example of such less contaminated area which is located just beside the Old Brahmaputra River, and the Pleistocene formations here are different from the Holocene geology of the Jessore district. This paper describes factors which effect As contamination of groundwater, namely, 1) the lithology and stratigraphy of sediments (Holocene vs. Pleistocene), 2) geochemical compositions of the sediments and 3) estimated aquifer redox conditions and groundwater quality. Finally we discuss mechanisms of arsenic release from the sediments.

Late Paleozoic High-Pressure Metamorphic Belts in Japan and Sikhote-Alin: Possible Oceanic Extension of the Chinese Dabie-Su-Lu Suture Detouring Korea

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Recent finding of eclogitic blueschist from Omi, central Japan (Tsujimori et al., 2000), revealed that the late Paleozoic ("older Sangun" or "Renge") high-pressure (HP) metamorphic belt in southwestern Japan reached eclogite facies in its progressive metamorphism, which is known to include lawsonite blueschist facies and epidote blueschist facies. The associated pelitic rock shows 340 Ma muscovite ^{40}Ar-^{39}Ar age (new data). In southwestern Japan, the Renge metamorphic rocks are dated 280-320 Ma through muscovite K-Ar and other methods (Nishimura, 1998; Tsujimori and Itaya, 1999), whereas the associated "younger Sangun" (or "Suo") blueschists are dated 170-230 Ma, suggesting long-lasting subduction (Nishimura, 1998). Western extension of these HP metamorphic belts is found in Ishigaki Island of Okinawa, where the metamorphic age is dated as 220-240 Ma (Faure et al., 1986).

The Renge blueschist is also reported from Joetsu area to the east of Omi as sporadic outcrops and numerous boulders in the Tertiary conglomerate, suggesting its widespread occurrence before Miocene. The pre-Miocene paleogeographic reconstructions by many workers put southwestern Japan

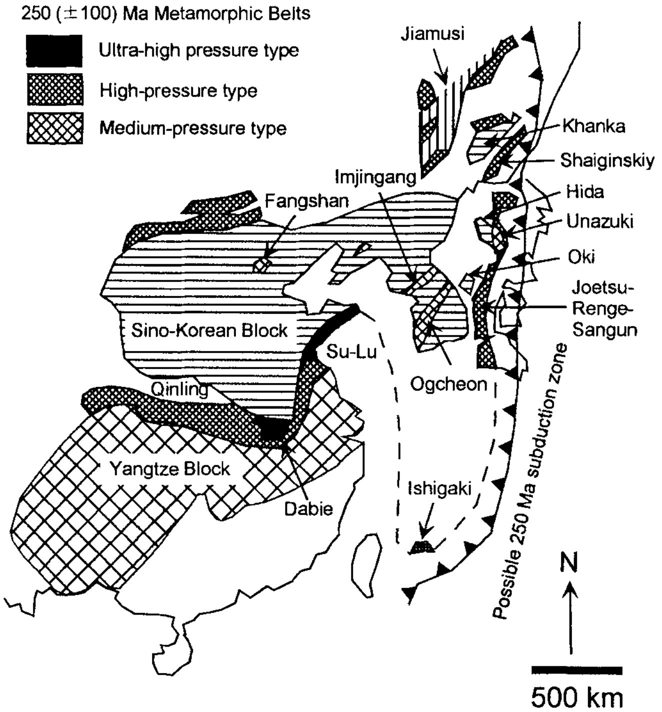

Fig. 1. Our "Yellow Sea" model for the eastern extension of the Dabie-Su-Lu UHP metamorphic belt (continental collision suture between the Sino-Korean and Yangtze blocks), which changes into the oceanic subduction zone represented by the Ryukyu-southwestern Japan-Sikhote-Alin HP metamorphic belts. Southwestern Japan is placed in its possible position in the Pre-Japan Sea time.

adjacent to the Sikhote-Alin, closing the Japan Sea in between. These reconstructions are supported by the continuation of the older geologic units such as Jurassic accretionary complexes and Paleozoic ophiolites (e.g., Kojima, 1989; Ishiwatari, 1994). Kovalenko and Khanchuk (1991) first discovered Shaiginskiy blueschist from Sikhote-Alin, and dated it 255-290 Ma, although our recent measurement yielded 230-250 Ma. These data indicate that the late Paleozoic-early Mesozoic HP metamorphic belts of 200-300 Ma age extends from Ishigaki Island through southwestern and central Japan (northern Kyushu, Chugoku, Omi-Renge and Joetsu) to southern Sikhote Alin.

The Dabie-SuLu suture between Sino-Korean block and Yangtze block is characterized by coesite-bearing, ultra high-pressure (UHP) metamorphic rocks, which are dated about 250 Ma (e.g., Ames et al., 1993). Some authors consider that the Su-Lu belt extends into Imjingang belt (e.g., Ree et al., 1996) or Kyonggi massif (e.g., Kim et al., 2000) in Korean Peninsula, although evidence for UHP or HP metamorphism has never been found from any of these belts. On the other hand, Teraoka et al. (1998) expressed an idea that the Su-Lu belt warps southward into the Yellow Sea before reaching Korean Peninsula, viewing a large-scale, eastward convex, bending geologic structure in Korean Peninsula. Moreover, Paleozoic stratigraphy is known to be contrasting between Sino-Korean and Yangtze blocks, and all of the Korean Peninsula is characterized by the Sino-Korean stratigraphy, which lacks Silurian, Devonian and Early Carboniferous strata (so-called "Great Hiatus").

A medium-pressure (kyanite-sillimanite type) metamorphic belt such as in the Imjingang or Ogcheon belt does not always signify major continental suture. The Fangshan medium-pressure metamorphic belt of 200-230 K-Ar ages is present in the middle of the Sino-Korean block near Zhoukoudian ("Peking-man") archeological site in western Beijing (Wang and Chen, 1996). The Hida gneiss complex, a small fragment of the Sino-Korean block in Japan (Jin and Ishiwatari, 1997), also accompanies 250 Ma Unazuki medium-pressure schist belt in its margin (Hiroi, 1981). With Imjingang and Ogcheon belts, they may represent intra-continental deformation associated with the Sino-Korean/Yangtze collision.

The above considerations lead us to propose a model presented in figure 1. Korean Peninsula as a whole is a part of the Sino-Korean block. The Qinling-Dabie suture is displaced northward into the Su-Lu belt, which turns southward in the Yellow Sea. Here, the continent/continent suture changes into the continent/ocean or ocean/ocean plate boundary, and appears again in Ishigaki Island near Taiwan as a blueschist belt, which is traceable all through southwestern Japan and further extends into Sikhote Alin. This model follows a general idea that the convergence of continental plates may cause UHP metamorphism, while that of oceanic plates causes normal HP metamorphism (Ernst and Liou, 1995). This model also suggests that the exposures of the UHP rocks are situated along the "promontory fronts" of the sinuous continental suture, namely the Dabie and Su-Lu areas, as in the case of the Western Alps.

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Cambrian Microfossils from the Altai Mountains and Their Implication to Geodynamic Evolution of the Paleo-Asian Ocean

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The Late Precambrian to Middle Paleozoic geological complexes related to the evolution of the Paleo-Asian Ocean are widely distributed in the Altai Mountains, central Asia. Ophiolites and accretionary complexes such as Zasurin Formation are found in the Katun and Charysh zones of Altai Mountains. Recent micropaleontological investigations of the Cambrian siliceous sedimentary rocks in Altai Mountains reveal the presence of microfossils (radiolarians, conodonts and sponge spicules). Based on the conodont biostratigraphic studies the age of the Zasurin Formation (Gorny Altai Series) was proved to be Late Cambrian-Early Ordovician (Tremadocian-Early Arenigian). Conodont assemblages of the Zasurin Formation comprise the following index species of the Late Cambrian; Westergaardodina matsushitai, Muellerodus erectus, Proconodonus, and Early Ordovician index species: Paltodus deltifer, Paroistodus proteus, Oepikodus evae, etc. Together with conodonts, radiolarians were recovered from the red cherts of the Zasurin Formation. Entactiniid Radiolaria (Inanigutta Nazarov and Inanibigutta Nazarov) were found for the first time from the Upper Cambrian. Paleomagnetic study of basalts in the Zasurin Formation suggests the paleo-latitude to be 4°N near equator. The Gorno-Altai Series is an accretionary complex and our micropaleontological study suggests that the accretion occurred during Late early Ordovician. The siliceous shales of the Lower Cambrian Shashkunar Formation (Botomian stage) yielded the oldest radiolarians in the world. Two new genera and four new species have been described: Archaeocenosphaera muricata Obut and Iwata, Altaiesphaera sparsispinosa Obut and Iwata, Altaiesphaera acanthophora Obut and Iwata, unnamed Radiolaria sp. A. The earliest radiolarians seem to have appeared in Early Cambrian (Botomian stage) near the equator of the Paleo-Asian Ocean. The Siberian continent is considered to have moved rapidly to the North during the Cambrian and Early Ordovician.

Grenville-Age Versus Pan-African Magnetic Anomaly Imprints in Western Dronning Maud Land, East Antarctica

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In this paper we examine aeromagnetic data from a part of the western margin of the Pan-African East Antarctic Orogen. The East Antarctic Orogen represents the southern continuation of the East African orogen that together formed during the collision of E- and W-Gondwana during Late Neoproterozoic/ Early Paleozoic times (ca. 580–515 Ma). The western margin of the East Antarctic Orogen is exposed in Heimefrontfjella, western Dronning Maud Land, where the western front of this orogen crops out as the Heimefront Shear Zone (Fig. 1) (Jacobs et al., 1997). Crust west of the Heimefront Shear Zone has typical Mesoproterozoic to Early Neoproterozoic (Grenville) age). K-Ar and Ar-Ar mineral cooling ages and magnetic anomalies are