Geochemical map of $^{87}Sr/^{86}Sr$ ratios using stream sediments is useful for detection of food-producing areas and human migration?

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Geochemical map of $^{87}Sr/^{86}Sr$ ratios is needed for multiple purposes of detection of food-producing areas, tracing of patterns of ancient human migration, and culture change in earlier times, as well as environmental applications. We have started a nationwide geochemical mapping of $^{87}Sr/^{86}Sr$ ratios using catchment outlet stream sediments (<180 μm) in Japan. The $^{87}Sr/^{86}Sr$ spatial distribution in Shikoku Island and the Kii Peninsula in Japan largely reflected underlying $^{87}Sr/^{86}Sr$ bedrock distribution [1]. The result shows that $^{87}Sr/^{86}Sr$ map using stream sediments is useful for investigating the geochemical and geological features of bedrocks. Meanswhile, $^{87}Sr/^{86}Sr$ values of stream sediments might not be indicative of biological $^{87}Sr/^{86}Sr$ values of vegetation and fauna. In this study, therefore, we investigated relationship between $^{87}Sr/^{86}Sr$ ratios in biological samples and in stream sediments collected around the sampling points. The samples used are rice-plants, animal bones, paddy water and soil, and stream water and sediments collected from an area distributing of granite bedrocks in Toyota, Japan. For soil and stream sediments, bulk Sr and ammonium acetate extractable Sr (exchangeable Sr) fractions were both analyzed. $^{87}Sr/^{86}Sr$ ratios were measured with thermal ionization mass spectrometer (TIMS; VG Sector 54) at Nagoya University.

The bulk Sr fractions in soil and stream sediments showed larger $^{87}Sr/^{86}Sr$ ratios than the exchangeable Sr fractions and biological samples. The $^{87}Sr/^{86}Sr$ ratios of exchangeable Sr fractions were in agreement with the $^{87}Sr/^{86}Sr$ ratios in biological samples within analytical errors. The results suggest that the $^{87}Sr/^{86}Sr$ ratio of biological samples is constrained by the $^{87}Sr/^{86}Sr$ ratio of catchment outlet stream sediments, that is, underlying bedrocks upstream of the sampling points, and that the $^{87}Sr/^{86}Sr$ map using stream sediments can be an important database for identifying food-producing areas and ancient human migration in archaeology.

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Tectonic and geothermal significance of thermal springs of Sicily Isl. (southern Italy)

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Rough morphology, thick (>5km) buried, trusted sequences of Mesozoic platform limestone and active faulting, in a very dynamic context at the boundary between the African and Eurasia plates, make Sicily a perfect place for the emergence of deep circulating waters as thermal springs. Most of them are located in its western sector (west Sicily springs=WSS); a few are related to the presence of the Etna and Iblei Mts Quaternary volcanics in eastern Sicily (ESS). Most of WSS are located along the seashore, or anyhow near the coast; others emerge inland at relatively higher elevations, but always at the edges of outcrops of the limestone sequences. The chemistry of springs suggests that the main circuit of WSS is inside the Mesozoic limestone, and the relative composition is: i) Ca-$SO_4(HCO_3)$ for those located inland, ii) markedly Na-Cl for those emerging along the sea, respectively. The $\delta^{18}O$ and δD composition of most of them suggests meteoric origin, with average recharge elevations at 700 m. Among WSS, the springs from Sciacca are the most promising for geothermal prospecting, since they seem to be a mixing between meteoric water and high temperature oxygen-shifted Mediterranean seawater. Moreover, they also have a CO_2 dominated associated gas phase suggesting the presence of a degassing hydrothermal system in the deep reservoir. Excluding the Sciacca springs in southern Sicily and some mud volcanoes at the foot of the Etna Mt., strongly CO_2-dominated and high in $^3He/^4He$ ratio, suggesting the presence of a mantle gas component, the gas phase associated to the carbonate WSS is N_2-dominated, reflecting the atmospheric recharge areas more than any deep hydrothermal systems.

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