Correlations of major and minor elements in Sound producing sand and silent beach sand in Japan summarized by principal component analysis (PCA)

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The sound producing sand is known as musical sand or "booming sand" and Japan is more common and widespread in occurrence. The sound producing sand is mostly composed of quartz and feldspar as well as silent beach sand. For sand to make the sound, clean surface is important factor and contamination on the surface does affect the sound process. Both sound producing sand and silent sand contains illite in surface contamination but more clay minerals have been found in silent beach sand.

The major and minor elements of sound producing sand and silent beach sand of Miyagi and Sannin area in Japan has been applied to Principal component analysis (PCA) where the multivariate data have been reduced to two dimensions and displayed as bi-plots. The correlation follows from properties related to the composition of the sands: quartz, feldspar, hornblende, magnetite, monazite, and clay minerals (illite and montmorillonite). Rare earth elements correlate well with elements (P, Ce, La, Nd, Th, Y) grouped by monazite in sound producing sand in Sannin area. The toxic minor elements especially Co, Ni, Cu and Zn correlate with clay mineral elements (K, Al, Mg, Fe, Si, Rb, Ba, Zn, Cr, V) in Miyagi and Sannin silent sand.

Raman and IR microspectroscopy of graphitic spheroids from 3.0Ga black chert, Cleaverville, Australia

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Almost all of the "microfossils" regarded as records of the ancient life have been discovered as carbonaceous materials in sediments. However, biological origin of Archean "microfossils" is still under debate (Westall, 1999; Brasier et al., 2002). Spectroscopic analyses by using laser Raman and IR microspectroscopy have been conducted on black graphitic parts called "microfossils", in order to find molecular traces of life.

Samples for this study are spheroidal carbonaceous objects in 3.0 Ga old black chert collected from the Cleaverville Formation, Western Australia (Ueno, 2002).

Micro-Raman spectroscopy showed that full width at half maximum (fwhm) of quartz in carbonaceous area tends to be larger than that of matrix quartz. Organic matter seems to induce low crystallinity of quartz. The D/O ratio (D-peak to O-peak area ratio of graphite) of the spheroidal organics tends to be smaller than that of form-less ones, indicating more disordered structures of the spheroids.

IR micro-mapping results revealed that the distributions of peak heights at 3400 cm^{-1} (molecular water H_2O) and 1300-1650 cm^{-1} (possibly C-N, N-H) are quite similar to those of carbonaceous matter. Almost all of the spheroids have "disordered graphite peak (D-peak)" which means structural deviations from well defined, three-dimensional sheet arrangement of graphite. Therefore, the carbonaceous matter may include polar molecules between graphitic layers.

These results suggest that the spheroidal carbonaceous matter has traces of polar components (such as C-N, N-H) and forms a complex with silica and water. These spectroscopic characteristics of the ancient carbonaceous matter have potential to be used as criteria for their biological origin.