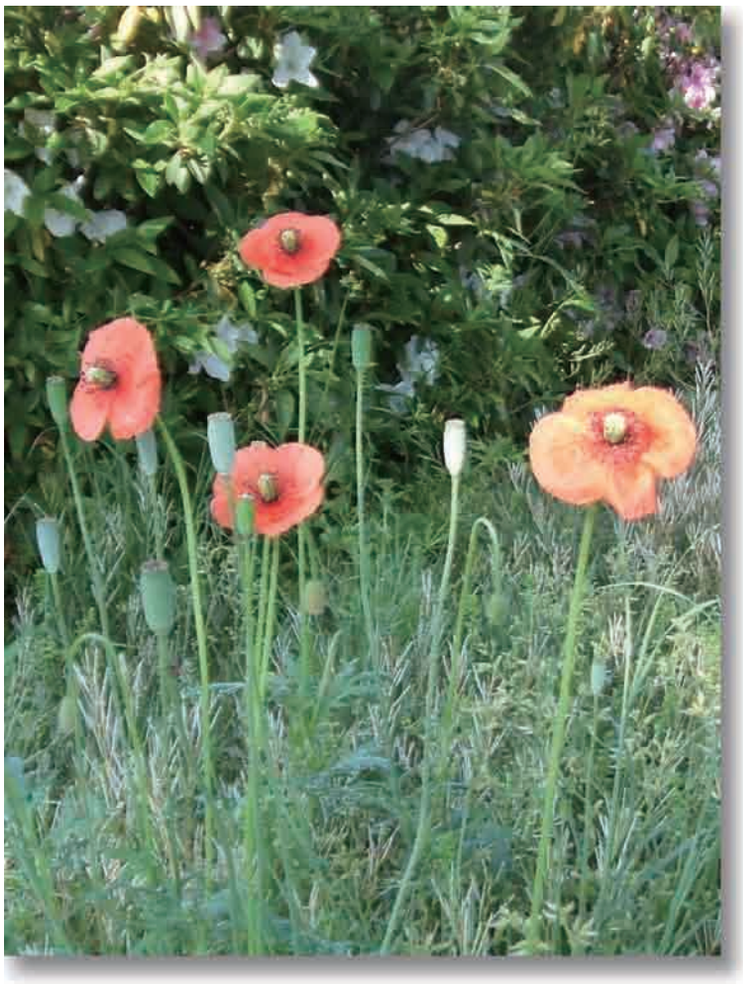
ENVIRONMENTAL



"Nagamihinageshi" - Long-headed poppy

This section covers the research area concerning environmental pollutants, artificial materials used for environmental protection, such as catalysts and extractants, and natural minerals of interest in geochemistry. Since many of the samples mentioned above are in an amorphous structure, X-ray absorption fine structure (XAFS) methods can be used most effectively. In fact, all the topics in this section involve investigations by XAFS methods. The number of proposals in this research area have gradually increased, and also higher-level information about the structure and chemical state of actual

SCIENCE

samples has been increasingly required. To address this situation, more sophisticated experimental techniques have been developed and practically applied to samples as described below.

The first topic concerns Sb compounds, which are considered to be pollutants of priority interest but their geochemical and environmental behaviors were largely unknown. Mithunobu *et al*. clarified the chemical states of dilute Sb in both solid and water phases to clarify the reaction of Sb in a soil-water environment in comparison with that of As.

In the second topic, Ikeda *et al*. investigated the mechanism of adsorption and separation by resin extractants for chemical substances such as trivalent actinides (An(III)) and lanthanides (Ln(III)). An(III)/Ln(III) intergroup separation using pyridine resin depends on the counter anions in the solute. They showed that this dependence was caused by the difference in the interaction between pyridine groups with An(III) and Ln(III) ions at the atomic scale using highly reliable Ln *K*-edge XAFS spectra.

The third topic concerns the surface reaction mechanism on Pt/C cathode catalysts in a fuel cell. Tada *et al*. developed a novel time-gating quick XAFS method for *in situ* time-resolved measurements. They succeeded in determining all the kinetic parameters for the electron transfer processes and redox structural changes during the rapid voltage operating processes for the first time.

The fourth topic concerns the anti-aging mechanism of Pt-supported CeZrY (Pt/CZY) catalysts, which extract harmful components from automotive exhausts such as NO_x and CO. Nagai *et al*. clarified that the formation of rigid Pt-O-Ce bonds on CZY suppresses the sintering of Pt and maintains its high catalytic activity after aging.

The fifth topic concerns the state-selective XAFS study of a Au/TiO_2 catalyst for low-temperature CO oxidation. Izumi *et al*. clarified the reason for the critical difference in catalytic activity depending on the Au particle size using a Au $L\alpha_1$-selecting Au L_3-edge XANES method, which selectively gave chemical state information for each Au site, such as anionic, neutral, and cationic sites.

The last topic concerns basic geochemistry for the age evaluation of materials by radiogenic ^{187}Re- ^{187}Os decay in molybdenite. Takahashi *et al*. examined the local structure around ^{187}Os using Os L_3-XAFS spectra, which were extracted by removing the intense X-rays from coexisting elements of Re and Mn using a fluorescence analyzer. They found that the valence and local structure of Os reflect the higher mobility of Os in molybdenite, which is related to the reliability of Re-Os dating.

Tomoya Uruga