

Formation rate of iron colloids at pH 2-3

NAGASAKI, Sagakuni^{1*}; YOKOYAMA, Tadashi²; HISATOMI, Osamu²; NAKASHIMA, Satoru²

¹Department of physics, Osaka University, ²Department of Earth and Space Science, Graduate School of Science, Osaka University

Various types of iron colloids are widely distributed in the earth's surface conditions, and their formation process, adsorption characteristic, and the material transport mediated by iron colloids are receiving attention. Iron colloids are often formed through several reactions including the dissolution of Fe²⁺ and Fe³⁺ from minerals, oxidation from Fe²⁺ to Fe³⁺, hydrolysis, and crystallization. In the present study, the reaction rate was evaluated focusing on the process in which iron colloids are formed from dissolved Fe³⁺.

A solution of Fe³⁺ 100 ppm was prepared by dissolving FeCl₃ into pure water. This solution was reacted at 15, 25, 35, 45, and 55 °C. At 25 °C, pH of the solution was ~2.7 at the start of the reaction and decreased to ~2.2 as reaction time passed. Such change in pH is known to occur as a result of the following reactions: hydration of Fe³⁺ (release of H⁺) → formation of dissolved Fe(OH)₃ → formation of solid Fe(OH)₃ (Grundl and Delwiche, 1993). Therefore, information of the formation rate of iron colloids can be obtained by monitoring the pH of the solution. After the initial period of the reaction in which the rate of the decrease of dissolved Fe(OH)₃ concentration was slow presumably due to nucleation, the concentration of dissolved Fe(OH)₃ decreased in a manner like first-order reaction, and the reaction behavior deviated from the first-order reaction at the later stage. By assuming first-order reaction, rate constants of 3.3E-5 - 1.1E-2 s⁻¹ were obtained at 15-55 °C, and good linearity was confirmed in an Arrhenius plot of these rate constants.

In addition to the above experiments in which time variation of the total amount of solid is considered, the time variation of the grain size of iron colloids was evaluated. A solution of Fe³⁺ 100 ppm was prepared and the change of grain size at 25 °C was continuously measured using a dynamic light scattering apparatus (Zetasizer μV, Malvern). As a result, enough scattering intensity began to be detected after the mean diameter of iron colloids grew to 10 nm, then the grain size increased. The increase of the grain size almost stopped after 8 hours, and mean diameter at this stage was approximately 30 - 40 nm. By evaluating the number of grains from the total amount of solid and mean grain size, the grain number was estimated to decrease with time.

Surface complexation modeling for lead adsorption on nano-sized aluminum silicate

USHIYAMA, Tomoki^{1*}; FUKUSHI, Keisuke²

¹Graduate School of Natural Science and Technology, Kanazawa University, ²Institute of Nature and Environmental Technology, Kanazawa University

There are many abandoned lead-produced mines in Japan. The water pollutions by lead due to the weathering of the mine wastes are environmental concern. The concentrations of lead released from the mine wastes is usually low. Therefore, the adsorption process is expected to dominate the mobility of lead in the affected area. It is well recognized that the materials widely occurred in earth surface conditions are comprised with low-crystalline and/or nano-sized minerals. There are some reports for lead adsorption behavior on crystalline phases such as clay minerals and low-crystalline iron oxides. On the other hand, there are very little reports on nano-sized aluminum silicates which must be dominant phases in surface condition. The quantitative understandings of lead adsorption on nano-sized aluminum silicate is essential for the prediction of lead migration in earth surface conditions. The purpose of the study is to clarify the lead adsorption behavior on nano-sized aluminum silicate under wide range of solution conditions and model the adsorption behavior by means of surface complexation modeling.

Keywords: nano-sized aluminum silicate, lead, adsorption, surface complexation modeling

Mineralogical study of serpentinite from Akamatsu, Yatsushiro, Kumamoto prefecture.

IWAKI, Yasuyo¹ ; ENJU, Satomi^{1*} ; UEHARA, Seiichiro¹

¹Department of Earth and Planetary Sciences, Faculty of Sciences, Kyushu University

Serpentine group minerals are one of the 1:1 layer type sheet silicates and the main component of serpentinite. They are classified into three mineral species chrysotile, lizardite and antigorite. The ideal formula of chrysotile and lizardite is $Mg_3Si_2O_5(OH)_4$ and that of antigorite is $Mg_{48}Si_{34}O_{85}(OH)_{62}$.

In our previous study, we researched serpentinite from a large area in Kyushu Kurosegawa belt (Tanaka et al., 2012), but there are only few reports for each area. So, the purpose of this study is to identify the composition minerals of serpentinite in Akamatsutaro Pass and Tanoura, located in west of Kyushu Kurosegawa belt, and to conduct a detailed study of serpentine.

Mineral species was identified by XRD pattern and serpentinite was classified into three type: antigorite main serpentine (Type AA, 16 specimens), antigorite rich serpentine (Type A, 10 specimens) and antigorite poor serpentine (Type LC, 8 specimens). Antigorite was most abundant. Magnetite, chromite, clinocllore, brucite and hydrotalcite group minerals were identified in specimens from both areas. Only the specimen from Akamatsutaro Pass had andradite, calcite, heazlewoodite (Ni_3S_2) and millerite (NiS), while forsterite, hydromagnesite, pyroaurite and awaruite (Ni_3Fe) were seen only in Tanoura. The supply of H_2S in Akamatsutaro Pass can be estimated from the presence of heazlewoodite and millerite. Relict forsterite was observed in serpentinites from Tanoura, indicating the smaller degree of serpentinization compared to Akamatsutaro Pass.

Serpentine contained in massive serpentinite had variable textures such as vein texture, reed shape texture and mesh texture with core and rim, which was formed after serpentinization of olivine. In the specimens of Type LC, mesh texture was often observed, and there were cores with no rim in samples without mesh textures. Also some core texture was replaced by reed shape texture. Chemical compositions obtained by SEM-EDS show some trends for serpentines in each texture. Reed shape texture contains 0.041 (apfu) Al which replaces Mg, while core texture contain 0.07 Al and rim texture contains 0.006 Al, so reed shape texture is rich Al than mesh texture. Reed shape texture contain larger amount of SiO_2 weight percent compared with the ideal formula of chrysotile and lizardite, and resemble that of antigorite.

Reference

K.Tanaka, T. Inoo and S. Uehara (2012): Microtexture and chemical composition of serpentine minerals from Kurosegawa belt, Kyushu, Japan. The 2nd Asian Clay Conference, Abstract Book.

Keywords: serpentine, antigorite, reed shape texture, mesh texture, Kyushu Kurosegawa belt, Yatsushiro

The lithium existence form in a lithium ore deposit

SUZUKI, Masaya^{1*} ; KON, Yoshiaki¹ ; EJIMA, Terumi¹ ; HIRABAYASHI, Eri¹ ; SATOU, Takumi¹ ; OOWADA, Akira¹ ; TAKAGI, Tetsuichi¹ ; TSUKIMURA, Katsuhiko¹ ; SAWAKI, Takayuki¹ ; MURAKAMI, Takayoshi² ; MOTOORI, Masayuki²

¹AIST, ²JOGMEC

In the ore deposit containing lithium, Spodumene, Petalite, Lepidolite, etc. are known as a lithium mineral, but these minerals are not contained in the lithium ore deposit examined this time. So, in this research, the result analyzed using XRD and SEM+EDS is released.

In the ore deposit containing lithium in this time, it roughly divides of a white portion and a portion of ashes green. From the result of XRD, it mainly becomes a white portion from Searlesite($\text{NaBSiO}_5(\text{OH})_2$), Calcite(CaCO_3), and Orthoclase(KAlSi_3O_8), and the mineral containing lithium is not shown. On the other hand into the portion of ashes green, Calcite(CaCO_3), Orthoclase(KAlSi_3O_8), Illite($\text{K}(\text{Al,Mg,Fe})_2(\text{Si,Al})_4\text{O}_{10}$), Rozenite($\text{FeSO}_4\cdot 4\text{H}_2\text{O}$), and Cryolite($\text{Li}_3\text{Na}_3\text{Al}_2\text{F}_{12}$) are contained was obtained. Since the peak of various minerals had appeared, it could not declare that Cryolite existed clearly, but it was suggested that Cryolite may exist as a lithium content mineral.

Next, from the results of SEM+EDS analysis, in the white part, Calcite and Orthoclase were contained at about 10-100 micrometers, and Searlesite existed in it at those circumferences. And in the green gray part, Orthoclase, Calcite, Illite, Rozenite were contained at about 10-30 micrometers, and the particle with a size of 1 micrometer or less existed in those circumferences. Although measurement of Li was not completed in analysis of EDS, it was checked that F is contained in the analysis of these microscopic particles.

From the above result, it was surmised that the lithium content mineral examined this time was Cryolite.

Keywords: lithium, ore deposit, mineral