Prevention of asbestos floating from outdated construction materials

HIROKAZU FUJIMAKI[1], KAZUHIRO SASAKI[2] AND SHUNICH HAMA[3]

[1]Graduate Schoole of Science, Tohoku University, Sendai, Japan (h-fujimaki@mail.tains.tohoku.ac.jp)
[2]Research Institute of Asbesto, Asbesto Safe Network, Sendai, Japan (sasaki@asbestos-safe.net)
[3]Research Institute of Eco 24 Co. Ltd, Tokyo, Japan (hama@eco24.jp)

Approaching Crisis

Human beings have used a huge amount of asbestos since the stone age because of it's good spinnability in the beginning and then because of good physico-chemical properties in industrialized nations. Asbestos is frequently used in construction materials, and they should start to fly as extremely fine fibers many years after they are used and when the construction materials are worn out. The fiber is believed to cause especially *malignant mesothelima* and other related diseases.

How to Cope with the Problem

Special reagent (Patent pending) has been invented to prevent asbestos floatation into the air. The reagent has high affinity with all kinds of asbestos and envelopes them when it is sprayed on the asbestos-containing materials. Once it envelopes asbestos and dried up, it is hardly possible to separate the reagent from asbestos. Among the asbestos, crocidolite asbestos is the most tough one and we treated crocidorite with the reagent. Then we leached it by strong sulfuric acid (1.8M) for more than 96 hours. The reagent-treated asbestos are then pulverized under 400 micron. Each fine fiber of crocidolite asbestos is entirely enveloped by the solidified reagent. As long as we observed them under the phase contrast microscope, we can hardly identify crocidolite. Using a highly efficient XRD, the crocidirite can be identified.

Conclusion

We of course prefer to recycle as many kinds of materials as possible. However, we may not able to recycle asbestos at all. On the contrary, we prefer asbestos-free atmosphere. When houses, buildings, facilities and their equipment are reconstructed or repaired, fine asbestos fibers may start to fly even if the construction materials are not yet worn out. Therfore, somehow floatation of fine asbestos fibers have to be prevented. We are going to show how the reagent works to prevent floatation of fibrous asbestos.

Reference

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Mass transfer by fluid and duration of oxygen isotope exchange during contact metamorphism at Hirao-dai, Japan

MAYUKO FUKUYAMA[1], YUICHI MORISHITA[1] AND TADAO NISHIYAMA[2]

[1]Advanced Industrial Science and Technology (AIST), Central7, Higashi 1-1-1, Tsukuba, Ibaraki,305-8567, Japan (m-fukuyama@aist.go.jp, y.morishita@aist.go.jp)
[2]Department of Earth and Environment, Kumamoto University (tadao@sci.kumamoto-u.ac.jp)

A reaction zone between a metamorphosed basic dyke (MB) and marble at Hirao-dai, north Kyushu, Japan, consists of well-organized sequential zones of diopside, garnet and wollastonite; textures are characteristic of diffusion-controlled structures. The reaction zone formed during contact metamorphism associated with intrusion of a Cretaceous granodiorite at about 300 MPa and 700°C (Fukuyama, *et al.*, 2004). The MB consists of diopside, biotite and plagioclase (X_{Ab}=0.4-0.8), whereas the marble is almost pure calcite.

Minimum estimate of time-integrated flux forming a reaction zone is 3.46 mol fluid/mol reaction zone: 1.29 mol fluid/mole as reactive fluid and 2.17 mol fluid/mol as non-reactive fluid. 1mol of reaction zone consists of 0.42 mol diopside, 0.11 mol garnet, and 0.48mol wollastonite from overall reaction: $0.07K_{2.00}Mg_{3.89}Fe_{1.42}Al_{2.48}Ti_{0.16}Si_{5.82}O_{20}(OH)_4$ + $0.02Na_{0.64}Ca_{0.36}Al_{1.36}Si_{2.64}O_8$ + $0.05CaMg_{0.77}Fe_{0.23}Si_{2.00}O_6$ + $1.15CaCO_3$ + $1.09SiO_2$ + $0.03FeO$ $0.02AlO_{3/2}$ = $0.42CaMg_{0.72}Fe_{0.28}Si_2O_6$ + $0.11Ca_{2.86}Fe_{0.14}Al_{2.00}Si_{3.00}O_{12}$ + $0.48CaSiO_3$ + $0.01TiO_2$ + $0.01NaO_{1/2}$ + $0.14KO_{1/2}$ + $0.14H_2O$ + $1.15CO_2$. This estimate is based on the mineralogical evidence and steady-diffusion modelling (Fukuyama *et al.*, 2006).

We measured ^{18}O and ^{13}C of calcite along a line segment perpendicular to the reaction zone-marble boundary. ^{13}O composition isn't change, but ^{18}O composition changes in proportion to distance from the reaction zone-marble contact. This shows that ^{18}O is strongly fractionated between $CaCO_3$ or CO_2 and H_2O because mineral reactions may buffer the CO_2-H_2O content of fluid.

The duration of oxygen isotope exchange (*t*) can be calculated from effective diffusive width (*W*) and diffusive coefficient of oxygen in calcite (*D*) using the following equation: $W^2=2Dt$

The minimum estimated duration of oxygen isotope exchange is 357 m.y. We interpret this duration is the same as the duration of reaction zone formed, giving the fluid velocity $5.3*10^{-11}$m/s.

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