

Origin of fluoride in groundwater, Lamphun city, Thailand

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High concentration of fluoride in groundwater has been reported in Lamphun City, Chiang Mai Basin, northwestern Thailand. In this area, groundwater is widely used for domestic purposes such as washing and cooking. Thus, inhabitants are at high risk of exposure to fluoride and of health hazard related to high intake of fluorine. The mixing of shallow groundwater with thermal water having high sodium and fluoride concentrations (Ratanasthien and Ramingwong, 1982), and the dissolution of fluoride from minerals and increase of sodium content by Na-Ca cation exchange (Asnachinda, 1997) are the two hypotheses proposed until now. However, both of the hypotheses have been proposed based on the fact that groundwater with high fluoride content is classified into Na-HCO₃ type. Thus, it is necessary to discuss whether either of the proposed hypotheses can explain the origin of the fluoride or both sources exist in the area.

To better understand the origin of fluoride, groundwater and sediments were sampled and analyzed. The dissolution tests of the sediments showed that the fluoride was dissolved from all the samples tested. Also, muscovite, a mineral containing fluorine, was detected by XRD. Thus, the sediments can be a possible origin of fluoride in the area. On the other hand, groundwater with high fluoride concentrations showed variable lithium concentrations. It is known that lithium is not common in shallow groundwater but its concentration can be high in thermal water because the dissolution rate of lithium is highly dependent on water temperature (James et al., 2003) and lithium can be used as a tracer of thermal water. Thus groundwater with high lithium concentration is considered to be mixed with thermal water and shallow groundwater. On the other hand, fluoride in groundwater with low lithium concentration has possibility to have its origin from dissolution of minerals in the sediments.

References

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