# Metal resource sciences based on elemental properties of rare metals revealed by speciation analysis

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Understanding of enrichment processes of metal ions in metal resources is important for the sustainable development of earth and our society, because the understanding contributes to the precise understanding of behaviors of various metal ions in various systems, which is in turn related to the effective exploration of metal ions and also practical use of the metal resources such as their refining and extraction processes.

We have developed various techniques on the speciation of various elements mainly using synchrotron radiation X-ray sources. In particular, X-ray absorption fine structure (XAFS) spectroscopy in bulk analysis and its various advanced methods such as with high spatial resolution (micro-XRF-XAFS) and high sensitivity (wavelength dispersive XAFS). The topics I will include in my presentation are as follows:

1. Speciation of rare earth elements (REE) in ion-adsorption ore related to its formation process and extraction of REE by ion-exchange reaction using ammonium ion.
2. REE in marine ferromanganese oxides and its comparison with ion-adsorption ore in terms of its formation under high saline water (seawater).
3. Transfer of REE from ferromanganese oxides to phosphate during diagenetic processes in marine sediments.
4. Enrichment of Pt in ferromanganese oxides by its speciation using high-sensitive XAFS method.
5. Comparison of host phases of Mo and W during change of redox condition in marine sediments.

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