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# X-ray Photoelectron Spectroscopic Study of Cobalt(II) and Nickel(II) Sorbed on Hectorite and Montmorillonite

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**Abstract:** The safe disposal of  $^{60}\text{Co}$ ,  $^{63}\text{Ni}$ , and  $^{59}\text{Ni}$  has required considerable information on the interactions of  $\text{Co}^{2+}$  and  $\text{Ni}^{2+}$  with clay minerals in the geosphere. X-ray photoelectron spectroscopy (XPS) has been used to probe the sorption sites for  $\text{Co}^{2+}$  and  $\text{Ni}^{2+}$  on hectorite and montmorillonite. The spectra were measured for Co-hectorite, Ni-hectorite, and Ni-montmorillonite immediately following ion exchange and after washing the clay two and five times with distilled water. The spectra, recorded following etching of the surface with an argon ion beam, differentiate two sorption sites; a labile (to washing) fraction sorbed as ion pairs, and a non-labile fraction sorbed by ion exchange at broken bond and interlamellar sites. The data were consistent with the sorption of metal ions ( $\text{Co}^{2+}$ ,  $\text{Ni}^{2+}$ ) in a common " $\text{MO}_6$ " ligand environment.

$\text{Co}^{2+}$  had a greater affinity for exchange on hectorite than did  $\text{Ni}^{2+}$ ; but  $\text{Ni}^{2+}$  had a greater affinity for the surface of montmorillonite than for hectorite. The argon ion etching of Ni-montmorillonite gave rise to a new photopeak of 853 eV, which was probably due to elemental Ni formed consequent to the chemical violation of the surface by ion etching.

**Key Words:** Cation exchange • Cobalt • Hectorite • Ligand exchange • Montmorillonite • Nickel • X-ray photoelectron spectroscopy

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