Pacific Northwest ferruginous bauxite deposits have formed in four main areas of northwestern Oregon and southwestern Washington by laterization of flows of the Columbia River Basalt Group (CRBG). The deposits, averaging 36.3% $\text{Al}_2\text{O}_3$, 31.8% $\text{Fe}_2\text{O}_3$, and 5.9% $\text{SiO}_2$, generally occur near the surface of hilltops in gently rolling areas. Two very different views have been advanced regarding the setting in which the deposits have formed. The first hypothesis calls for a blanket-type laterization by erosion of much of the original deposit upon uplift and dissection of the area.
The second proposes that laterization followed uplift and only a limited amount of bauxite developed. Deposits found within the Salem Hills provide insight into this question and into questions involving the conditions under which the deposits formed and the role parent material played in controlling the distribution and composition of ferruginous bauxite. A very strong correlation, both in plan and section view, exists between the distribution of the informal Kelley Hollow flow of the Frenchman Springs Member of the Wanapum Basalt Formation and the occurrence of ferruginous bauxite. Geochemical variation for 12 major, minor, and trace elements in 3 laterite profiles is markedly greater in the weathering products of the Kelley Hollow flow than those of the underlying high MgO Grande Ronde flow and appears to be related to structural and textural properties of the two flows. La, Sm, and Ce; Hf, Th, and Sc; and Co and MnO form three groups of elements which display sympathetic geochemical variation in concentration or depletion relative to parent material concentration within the laterite profiles. $\text{Al}_2\text{O}_3$ and $\text{Fe}_2\text{O}_3$ relative concentrations tend to vary oppositely though both are significantly concentrated in most samples. $\text{SiO}_2$ and Cr variations do not relate to any of the other elements. Eh-pH equilibria for the Al-Fe-H-O system suggest that pH within the weathering environment was generally above 3-4 but less than 8-10 and that Eh was generally greater than 0. Silica depletion, the key process to the
development of these ferruginous bauxites, was dependent upon removal of leachate by ground water flushing action, a process which would presumably require topographic relief. Well developed, lateral ground water flow above a clay-rich interbed at the base of the Kelley Hollow flow further enhanced the flushing action. The deposits developed after deposition of the Kelley Hollow flow and after the development of an active ground water system in the area. The mineralogy of the laterite profiles requires a climate having alternating wet and dry seasons during the development of the deposits. The ferruginous bauxite may have been more extensive than it presently is but a blanket type laterization is not supported by the evidence produced in this study.