

## The Volcanism and Geochemistry of Parts of the Endeavour Segment of the Juan de Fuca Ridge System and Associated Seamounts

M.I. Leybourne and N.A. Van Wagoner

*Department of Geology, Acadia University, Wolfville, Nova Scotia B0P 1X0*

During the 1987 GSC cruise to the Endeavour Ridge, the northernmost segment of the Juan de Fuca Ridge system, limited dredging was carried out in West Valley. West Valley is spreading at 5.8 cm/year and is physiographically similar to slow-spreading centres such as the MAR. Basaltic rocks were recovered from two locations along the axial valley of West Valley and a third from the west wall of the valley. These sample sites were augmented with rocks collected from the Heck and Heckle seamount chains, the Sovanco Fracture Zone, and West and Middle Ridges by Barr between 1969 and 1971, and from the Endeavour Ridge south of the Endeavour Offset by the GSC in 1986. The purpose of sampling was (1) to determine spatial and temporal variations in the physical and chemical characteristics of the volcanism of the study area and compare this with adjacent ridge segments and other mid-ocean ridge systems in the Atlantic and Pacific oceans, and (2) to determine the relationships between West Valley volcanism, the associated seamount chains, and the Sovanco Fracture Zone. Rocks were analyzed for physical characteristics and degree of alteration, modal mineral content and mineral chemistry, and major-, trace- and rare-earth-element geochemistry of whole rock and fresh glass samples.

Rocks collected from the axial valley of West Valley have fresh glass, indicating that volcanism is young and suggesting

that the valley is actively spreading. Samples from the valley wall are covered with a Mn-crust reflecting the older age of these rocks. The rocks range from primitive ( $Mg^{\#}=68$ ) to differentiated ( $Mg^{\#}=54$ ) compositions. Primitive lavas contain anorthitic plagioclase (with rim compositions up to An 89), forsteritic olivine (Fo 88) and chrome spinel ( $Cr_2O_3$ , 25-30%). The phenocryst assemblage of the most differentiated lavas is plagioclase (rim compositions as low as An 65), olivine (Fo 77) and clinopyroxene; spinel is absent. The Endeavor Ridge samples are chemically similar to ridge systems to the north and south in that they are enriched in the incompatible elements and LREE (T-type MORB). The West Ridge, West Valley, and Middle Ridge samples are depleted in these elements (N-type MORB) compared to the Explorer and Juan de Fuca ridges and are similar in compositional diversity to lavas of the FAMOUS area of the Mid-Atlantic Ridge. The seamount samples are also N-type MORBs. The samples from the Sovanco Fracture Zone are mostly intermediate in composition between these areas. The seamount samples, although not obviously chemically distinct, exhibit flow structures indicative of low extrusion viscosities, to a degree not observed at the other sample sites. The explanation for these low viscosities is under investigation.