The forearc area of the northern Cordillera preserves Tertiary magmatism in a semi-continuous belt from Alaska to Oregon. Vancouver Island is situated in a central position within this belt and contains five suites of Paleogene igneous rocks, three of which were studied for this thesis: the Mt. Washington intrusions, the Clayoquot intrusions and the Flores volcanic rocks. Eight new U-Pb zircon ages were obtained for the Mt. Washington and Clayoquot intrusions (51.2 +/- 0.4, 48.8 +/- 0.5 Ma, 38.6 +/- 0.3, 38.6 +/- 0.2, 37.4 +/- 0.2, 36.9 +/- 0.2, 35.4 +/- 0.2 and 35.3 +/- 0.3 Ma). The geochemical compositions of these three suites range from granite to tonalite. Some units display an adakitic trace element signature (commonly associated with slab melting) but have S-type character (indicative of sedimentary source rock) and are interpreted to be anatectic melts of subducted forearc sediment. Forward modelling of tectonic plate configurations in the Pacific basin from 53 Ma to the present was carried out to identify the most plausible plate configuration for forearc magmatism from Alaska to Oregon. Ridge-trench intersection and slab window formation were regarded as the most likely causes of the forearc magmatism, and were used to constrain the plate configurations. The model invoked the recently proposed Resurrection plate in addition to the Kula, Farallon and Pacific plates. The modelling suggests that at ~46 Ma, the Resurrection plate became segmented into two plates, the more northern of which is herein named the Eshamy plate.

The plate model not only accounts for the majority of Tertiary forearc magmatism from Alaska to Oregon, but is also in close accord with Tertiary to Recent inboard magmatic and structural features.