

Miocene vegetation in the Columbia River Basalt Province, Washington State, USA

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The Columbia River Basalt Province (CRBP) provides excellent records of the effect of different types of volcanism on palaeo-vegetation dynamics. The CRBP is a Miocene-age continental Large Igneous Province (LIP) within the Columbia Basin in South Washington, North Oregon and West Idaho, USA. The province comprises a number of extensive basaltic lava flows, intercalated with sedimentary interbeds of fluvial, lacustrine and associated palaeosol environments. Based on sedimentary facies analysis the intra-basaltic drainage system development can be divided into an early, middle and late stage.

The early stage of CRBP evolution is characterised by high volcanic effusion rates and effusion volumes. Palynological data record vegetation, which is dominated by *Taxodium*, *Alnus*, *Castanae*, *Tilia*, *Pterocarya*, *Carya*, *Platycarya*, *Ulmus*, fresh water green algae (*Schizosporis*), fungi, ferns and fern allies (*Filicopsida* and *Sphagnaceae*).

The middle stage CRBP evolution marks the onset of waning LIP volcanism. The vegetation is characterised by mainly *Nyssa*, *Taxodium*, various mosses, ferns and fern allies, as well as increased fungal colonisations establishing in predominantly shallow lakes, swamps and wetland environments.

Late stage CRBP evolution is characterised by low eruption rates, and an increase in felsic ash delivery from the Cascade Range and the Yellowstone Hotspot. The vegetation is dominated by *Alnus*, *Nyssa*, *Ilex*, ferns (*Osmunda*), mosses (*Sphagnaceae*, *Lycopodium*), fresh-water green algae and fungal colonisations. Despite low effusion rates and effusion volumes associated with large fluvial and lacustrine environments (up to 45 m thick interbeds) establishing on the lava field, the vegetation record is relatively poor. The less-evolved flora diversity is inferred to relate to the up to 2 m thick ash fall out deposits, which covered wide areas of the lava field leading to a lack of nutrients supply, soil acidification and a vegetation regression.