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# 4. Volcanic Geology of Edmonson Point, Mt. Melbourne Volcanic Field, North Victoria Land, Antarctica

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The Edmonson Point volcanic complex is part of the Mt. Melbourne Volcanic Field of the McMurdo Volcanic Group of Victoria Land, Antarctica (KYLE & COLE 1978, WÖRNER & VIERECK 1989, 1990, KYLE 1990). McMurdo Volcanics occur within and to the west of the Transantarctic Mountains and are related to rifting processes within the Ross Sea basin. Rapid uplift of the Transantarctic Mountains during the past 50 Ma (FITZGERALD et al. 1987) and deep burial of Cenozoic sediments within the Victoria Land Basin and Terror Rift (COOPER & DAVEY 1987) are the main structural features of this rift system in the study area.

Typical rift-related lavas of the Mt. Melbourne Volcanic field range from basanites and alkalibasalts to highly evolved comenditic trachytes. Where eruptions have taken place below glaciers, a complex succession from subglacial to subaerial volcanics may be observed (WÖRNER & VIERECK 1987) which can be of use to determine past glacial history.

Detailed investigations on the volcanic complex of Edmonson Point (EP) to the E of Mt. Melbourne define four main phases of activity (I-IV in Fig. 1). Eruptions started with subaerial strombolian/subplinian trachytic pumice and scoria deposits near the coast (Ia) overlain by trachytic pumice deposits and lahars (Ib) which show evidence of deformation and compressive tectonism by moving glaciers. These older tephra are cut by fluvial erosion. A younger sequence of uniform benmoreite lavas changes from subaerial to strombolian scoria (II) to a complex of partly palagonized phreatomagmatic tuff cones (IIIa, „main EP cone“) grading into subaerial scoria and associated lavas (IIIb). This cone complex is overlain by subaerial to subaqueous lava flows and cut by dikes (IV) which indicate a quickly changing (melt-) water level rising from 20 m to 130 m a.s.l. Abundant intrusions into phase III tuff cone may belong to this phase. The youngest activity at Edmonson Point is represented by eruptions of late subaqueous pillow lavas to subaerial scoria along an E-W fissure (IV).

Stratigraphic relations as well as a profile through the Edmonson Point volcanics complex is illustrated in Figures 1 and 2. Eruptions produced text book examples of tuff cone deposits, mega pillows with exceptionally large pipe vesicles and a dike intruding into a subaqueous environment which resulted in a folded, marginally chilled shallow intrusive body. Total erupted volume is crudely estimated to 0.1 $km^3$. Chemical variations (WÖRNER et al. 1989) are rather small: Phase Ia and Ib trachytes are slightly variable and represent the most evolved lavas of the sequence at Edmonson Point. The main phases of the EP complex, however, produced chemically surprisingly uniform benmoreite lavas (e.g. MgO content 0.58 to 0.85 wt. %, Zr of 508 to 557 ppm) with no systematic changes between centres and different lithological types (pumice, scoria, dikes, lava flows, pillows). There is, however, a slight tendency for younger lavas (phase IV) to be somewhat more evolved. Density and viscosity of this homogeneous magma are strongly dependent on volatile contents of Edmonson Point lavas which apparently has been quite variable.

Different lithologies can then be explained by variable eruption and fragmentation processes governed by (i) interaction between lavas and glacial melt water, (ii) variable primary gas content and thus magmatic degassing, (iii) variable viscosity due to different volatile and vesicle content, all of the above being interdependent parameters.

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## Stratigraphic sections through Edmonson Point tephra and lavas

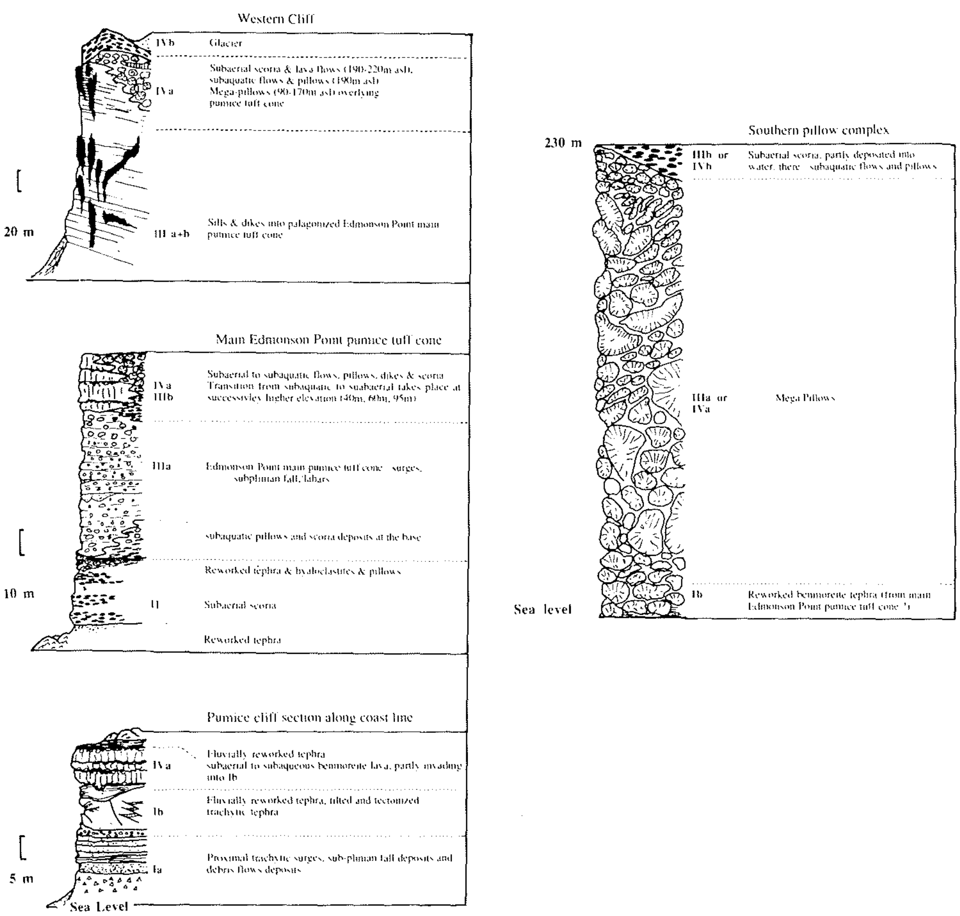


**Fig. 1:** Stratigraphic sections through Edmonson Point tephra and lavas.

**Abb. 1:** Stratigraphie der vulkanischen Abfolge am Edmonson Point.

Our results suggest a complex evolution of the glacial environment with interplay between subaerial phreatomagmatic eruption and subsequent rise in melt water level up to 220 m a.s.l. This situation is only compatible with melting of glaciers and ponding of melt water due to growth of volcanic structures within and beyond the Edmonson Point area.

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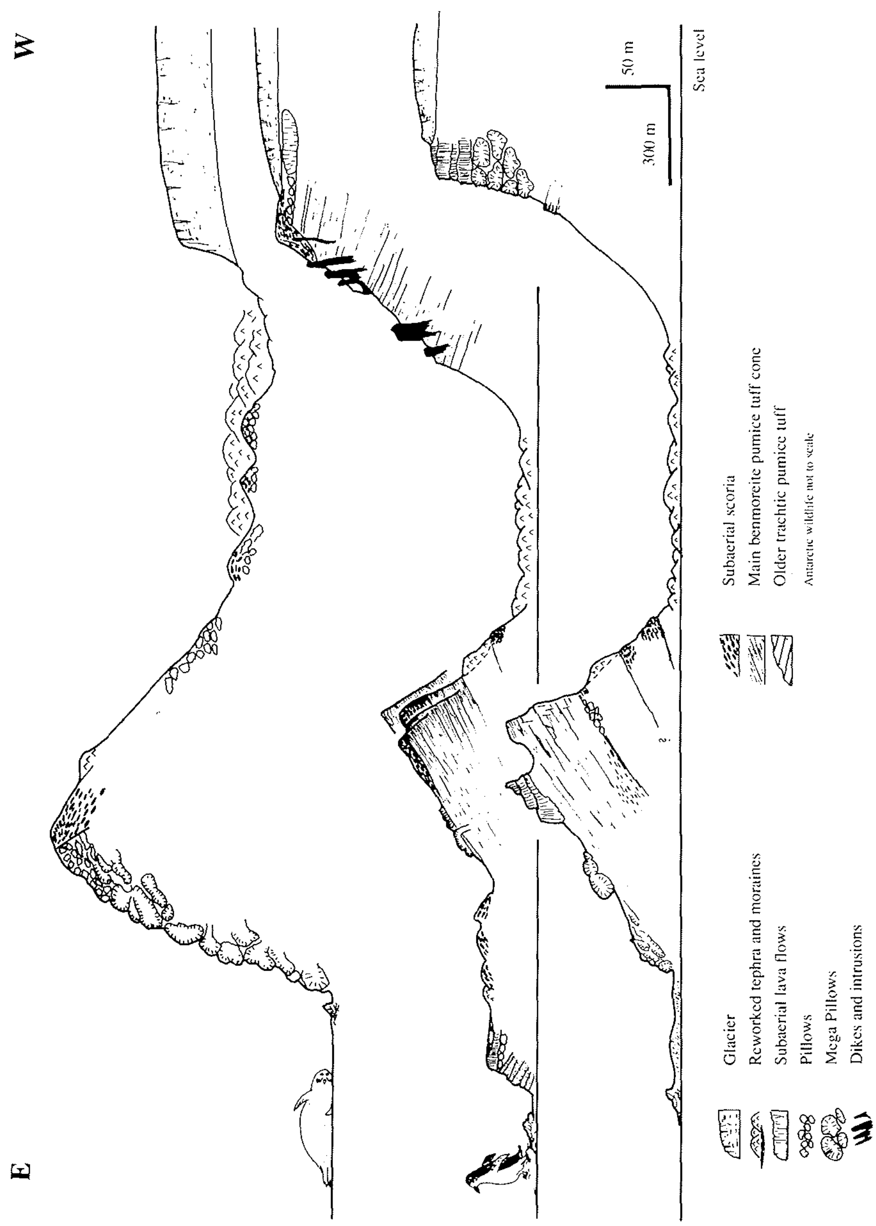


**Fig. 2:** Schematic cross sections through the volcanic succession of Edmonson Point.

**Abb. 2:** Schematische Profile durch Edmonson Point.


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