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THE DEVONIAN INTRAPLATE VOLCANISM OF THE NORTHERN GRAYWACKE ZONE, EASTERN ALPS

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The Northern Graywacke Zone belongs to the Upper Austroalpine nappe system. These Paleozoic polymetamorphic rocks include important volumina of various basic magmatites, with maximum thicknesses of 400 m. At two localities within these low-grade metamorphic rocks the age of the basic volcanites was determined by fossils: Silurian in the eastern part of Graywacke zone (Eisenerz Graywacke Zone; SCHÖNLAUB, 1982) and Lower Devonian in the western part (Kitzbühel Graywacke Zone; HEINISCH et al., 1987).

Detailed volcanological and geochemical investigations, basing on a vast data collection, lead to a new geodynamic interpretation of the basic magmatism.

By a combination of caracteristics derived from different relic volcanogenic textures (pillows, hyaloclastites, pumice lapilli, scoria etc.) an island volcano-model can be reconstructed: The basis part is built up by pillow-basalts and gabbroic sills. When reaching shallow water, explosive volcanism with different pyroclastics is dominant (lapilli and ash tuffs etc.). On the slopes and within the basins reworked volcanic debris (tuffites) is deposited. Highly vesicular pumice lapilli and beach boulders prove temporary subaerial stages. Widespread and thick pyroclastic sequences show that most of the eruptions took place above the PCL (pressure compensation level; FISHER, 1984). This determines a maximum depth of water of ca. 500 m for extrusion.

Geochemically, most of the rocks are transitional basalts and alkalibasalts, subordinate some tholeiites occur. All samples are enriched in immobile incompatible elements (P, Zr, Nb), particularly in Ti and the light rare earth elements (LREE). Discrimination diagrams and typical element ratios (e.g. Hf/Ta<2) point out the genesis of the rocks in a within-plate geotectonic position. There is a good accordance with the typical element patterns of ocean island basalts (e.g. strong enrichment of the elements Ti, P, Zr, Nb, Th and Ta relativ to an average MORB composition). A lherzolitic mantle material, primarily enriched in incompatible elements is suggested as source rock

(SCHLAEGEL-BLAUT, 1990).

In addition to these intraplate-magmatites, in a small area in the Western Graywacke Zone a thick sequence of pillow- and sheetflows exists (basalt-sill complex of Maishofen); the volcanological investigations prove an extrusion depth in deeper water, below the PCL. The geochemical characteristics of these rocks are ambiguous. They are less enriched in incompatible elements, and show affinities to MORB's and intraplate basalts as well as to island-arc tholeiites. Based on recent field results, a model is presented which relates the basalt-sill complex to an independent magmatic event, which must be younger than the Lower Devonian intraplate volcanism.

Many of the sometimes contradictory plate tectonic models for the Alpine Paleozoic were based on the basic volcanism of the Graywacke Zone. The data presented here require a revision of the various models. The basic magmatism is not connected with supposed Caledonian movements, but belongs to the Variscan history. The overwhelming majority of the examined rocks displays neither a relationship to an active plate margin, nor to a mature ocean ridge and even a subduction event can be excluded. In the new genetic model presented, the basic intraplate volcanism is correlated with volcanic buildings (e.g. seamounts, island volcanoes) in a shallow marine environment. This is in good accordance with the sedimentological data (HEINISCH, 1988) which prove a nearby passive continental margin. Very similar to the Variscan belt of Central Europe in general, also in the Alpine realm is no evidence for a completely developed ocean. The Silurian-Devonian basic intraplate magmatism of the Graywacke Zone represents a phase of extensional tectonics and is probably in connection with mantle-plume mechanisms.

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