Cyclic sediments and algal reefs in the Lower Permian of the Carnic Alps

The objectives of the applied project are the study of the architecture, composition and origin of (a) sedimentary cycles ("cyclothems") and (b) reef mounds of the Lower Permian in the Carnic Alps and Karawanken Mountains (Southern Alps, Austria) and in southern New Mexico (USA). The late Carboniferous to early Permian was an icehouse world characterized by climatic changes causing waxing and waning of the giant Gondwanan ice shield. These climatic changes caused glacio-eustatic sea-level changes which strongly influenced sedi-mentary processes on stable shelf areas, resulting in the formation of cyclic sediments (cyclothems). Late Paleozoic cyclic sediments occur in North America, Europe and Russia. In the Carnic Alps cyclic sediments continue throughout the Auernig and Rattendorf Groups, but are not known from the Trogkofel Group. In New Mexico cyclic sediments of glacio-eustatic origin are reported from the Pennsylvanian of the Pedregosa and Orogrande basins. Cyclic sediments are also known from the Lower Permain (Wolfcampian – Leonardian) al-though it is not known whether these cycles are of glacio-eustatic origin or the result of tec-tonic or other processes. Although the age control for the upper part of the Rattendorf Group is not very well established, biostratigraphic data indicate that in the Late Paleozoic succession (Auernig and Rattendorf Groups) of the Carnic Alps different types of cycles are present and that the duration of cycles increased from the Auernig Group to the upper part of the Ratten-dorf Group. We plan to study in detail if and how cyclicity changed from the Auernig Group to the Rattendorf Group and if there is any cyclicity within the Trogkofel Group. One major objec-tive of the project is to study how sedimentation during the early Permian was affected by tectonics and glacio-eustasy and if major glacio-eustatic sea-level changes are synchronous and worldwide and thus can be correlated from the Carnic Alps to New Mexico.

Glacio-eustatic cycles are difficult to recognize as relative sea-level is mainly the result of interplay between subsidence, sediment supply, and global eustasy. There are other processes which might involve frequencies and amplitudes suitable for sequences of stacked cyclothems such as tectonic movements, autogenic processes, flexure of lithosphere or repetitive glacio-eustatic sea-level fluctuations. All these processes may generate “cyclothems” of similar thickness, but their lateral extent would be quite different.

Another topic are the mounds particularly those of the Trogkofel Group which according to own observations are much more complex than hitherto known. We plan to study the lateral and vertical facies changes, size and geometry of the Trogkofel mounds of the Carnic Alps and Karawanken Mountains and to compare the Lower Permian mounds of the Carnic Alps and Karawanken Mountains with those of New Mexico where mounds are common in the shallow marine carbonate successions of the Orogrande Basin (Hueco Group, Laborcita For-mation) and Pedregosa Basin (Horquilla Limestone). It seems that calcareous algae, the main mound-building organisms, are more abundant in the Lower Permian of the Carnic Alps than in New Mexico although both locations were situated in a similar position just a few degrees north of the paleoequator. It is of interest if climatic changes occurred and are documented in the Lower Permian sedimentary record and how these climatic changes influenced sedi-mentation on the shelf.