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The geological history of the Carnic Alps in a global context

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The Carnic Alps of southern Austria and northern Italy represent an outstanding combination of internationally significant geological and geomorphological features. The area comprises largely unspoiled nature of unrivalled beauty. Its geology spanning the interval from the Middle Ordovician to the Triassic Periods reflects approx. 250 million years of the Earth's history, including a number of internationally important time-markers, reference sections and fossil localities. The property also contains a large range of outstanding landscape features. It is renowned for its contribution to Earth science-related activities for almost 200 years including geology, structural geology, paleontology, sedimentology, geochemistry, and Quaternary research. The rich paleontological heritage of both faunas and floras of the Paleozoic strata of the Carnic Alps is documented in several hundred scientific publications; based on more than 1500 scientific publications the Carnic Alps are considered by Earth scientists as one of the most intensively studied areas in the world.

In the Lower Palaeozoic the record of life comprises different marine environments ranging from shallow water lagoonal deposits to coral-stromatoporoid buildups, fore-reef, slope to off-shore pelagic settings. The faunal spectrum covers planctonic, nectonic and benthonic animal groups.

With regard to the Paleozoic Era, the 90 most famous world fossil sites have almost nothing in common with the Carnic Alps since they mainly comprise freshwater and shallow marine faunas (tetrapods, arthropods, fishes).

Conclusions from a comparative analysis of the properties inscribed in the UNESCO World Heritage List (WHL) reveal that, with few exceptions, major stages in Earth‘s history are not sufficiently represented in the WHL.

In fact, there is no other property than the Carnic Alps comprising six successive stages wich range from the Middle Ordovician to the Middle Triassic providing evidences of drifting plates, shifting palaeoclimates and mountain building processes.

Rocks and fossils suggest a continuous northward drift of one of the Peri-Gondwanide terranes from high southern and cool-tempered latitudes in the Ordovician to the moderate and tropical belt in the Silurian, Devonian and Carboniferous followed by an equatorial position with desert conditions in the Permian; ongoing drifting during the remaining 250 m.y. moved the continental plates to the present position. Recently, palaeomagnetic data have confirmed these settings.

The Carnic Alps fill an other important gap in Earth‘s history by documenting the Variscan Orogeny in the Middle Carboniferous. It is represented by texbook-like examples of an angular unconformity between the pre-Variscan basement rocks and the post-Variscan cover sequences.

Following the Variscan Orogeny, the late Upper Carboniferous and Lower Permian shallow-water deposits range from coastal swamps to those of an intertidal shelf embayment of the expanding Tethys Sea. They are characterized by exceptionally rich faunal and floral remains. During the late Lower Permian shelf-edge reefal deposits accumulated which were terminated due to an uplift event resulting in a short gap in sedimentation and subsequent karstification. In the Middle and Upper Permian this episode was succeeded by the red clastics of the Gröden Formation and the locally evaporitic Bellerophon Formation.

Ongoing research by different national and international working groups will certainly expand the already impressive base of knowledge in this mountain region.