Block, thrust and escape-related rotations in the Central Northern Calcareous Alps

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The Northern Calcareous Alps (NCA) belong to the Upper Austroalpine units (Eastern Alps) and represent one of the largest structural units of the Alps. The application of paleomagnetic methods in this part of the orogen started very early and was focused on the reconstruction of the thrust system evolution, in paleogeographical reconstruction's or in large-scale interpretations after the appearance of the escape hypothesis. However, the extension of the NCA together with their complex geological evolution contrasts with the amount and distribution of data available (less than one hundred sites) and the diversity of interpretations. Data with adequate quality (statistically) based on new instrumentation and precise age control of the magnetization (proved by stability test) are essential in any single structural unit. Structural units must be treated independently to isolate and separate the vertical axis rotation related with the thrust or block systems arrangement (relative rotation among units) from large scale movements and/or inherited paleogeographical configurations.

In this work, we present data from more than 100 paleomagnetic sites located in the Salzkammergut area. Stratigraphic distribution spans from Lower Triassic to Lower Cretaceous and all of them are situated in Tirolic units. About 70 new sites (including 4 long magnetostratigraphical sections) have been joined to almost 40 sites from previous studies. A great diversity of magnetic behaviors allows us to define up to three magnetic directions mostly carried by low coercitivity minerals with unblocking temperatures of 350° (J1), 500° (J2) and 680° (J3), respectively. J1 and J2 have always positive inclinations and J3, when present (only a few sites), shows two polarities. The whole set shows good results and reveals three main observations: A systematic clockwise rotation which fits with previous observations. J2 or J3 display always higher rotation values than J1. When appear together (most cases), J1 displays constant inclinations everywhere but J2 shows different inclinations depending on the structural position of the sites (north or southwards dips).

Taking into consideration the fold test results (applied separately in the North and South sectors), J1 and J2 can be interpreted as pervasive post and syn-folding remagnetizations respectively. In most cases the original information (J3) has been completely reset. They show different degrees of rotation in the different blocks. J3 can be considered as primary (two polarities). In view of the geodynamic evolution and the observed inclinations, the second remagnetization event (J1) could have taken place much later than the final configuration of the Tirolic system and around the age of both the thrusting of the NCA over the Flysch and the Tauern window uplift. From this moment on, the NCA behaved like a unit and J1 would record the main stage of rotation (60° in average) associated with the collision and the extrusion. J2 would have been acquired during the Tirolic thrusting and then, the differences between J2 and J1 (15° in average) would be the rotations related with the lateral differences of shortening of this system.

A paleomagnetic cross section through the Eastern Northern Calcareous Alps: preliminary data in the Mariazell meridian

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More than eighty new paleomagnetic sites have been investigated in the Eastern Northern Calcareous Alps. The sites are located in the Mariazell meridian (about 15° 30´ East longitude) and span from Scheibbs in the North to Kapfenberg in the South. From the structural point of view, these sites cover mainly the Northern Calcareous Alps (NCA) nappes but some sites were also taken in the Helvetic and Penninic flysch units as well as in the Greywacke Zone. At least 5 sites (8 to 10 oriented cores) per thrust sheet or nappe were obtained in order to check properly the age of the magnetization by means of fold tests: Frankenfelds, Lunz, Sulzbach and Reisalpen nappes (Bajuvarikum); Ötscher, Göller, Rotwald-Gindelstein nappes (Tirolikum); Mürzalpen, Proles, and