GEODYNAMIC SIGNIFICANCE OF PALEOZOIC SANDSTONES IN THE EASTERN ALPS

F. NEUBAUER

Dept. of Geology and Paleontology, University of Salzburg, Hellbrunner Str. 34, A5020 Salzburg, Austria

Compositions of late Ordovician to Late Carboniferous sandstones of the Eastern Alps have been examined in order to (1) test the DICKINSON–GAZZI method; (2) to evaluate the Paleozoic geodynamic evolution of the Eastern Alps; and, finally, (3) to proof possible differences between the Austroalpine and Southalpine units of the Alps. Ca. 280 samples were selected from Carnic Alps (CA) as representative of the Southalpine unit, and from the Gurktal nappe complex (GNC), the Paleozoic of Graz (PG) and the eastern Grauwacken zone (GWZ) as representatives for the Austroalpine unit. An extended version of the DICKINSON–GAZZI method has been used for analysis. Variations of sandstone compositions through time are given in Fig.1 which displays trends from the CA vs. the GWZ section.

The Southalpine and Austroalpine units generally display similar trends. During Ordovician a shift from (volcanogenic) graywackes to quartz arenite is observed. Silurian to Early Devonian samples mostly quartz–rich compositions due to a mature source recording the formation of an epicontinental and/or passive continental margin. Variations of the plagioclase/K–feldspar ratio allow detailed correlation of otherwise undated sections. Sandstones of the Laufnitzdorf Fm. within the PG form a major exception. These sandstones reflect high volcanogenic input due to a possible

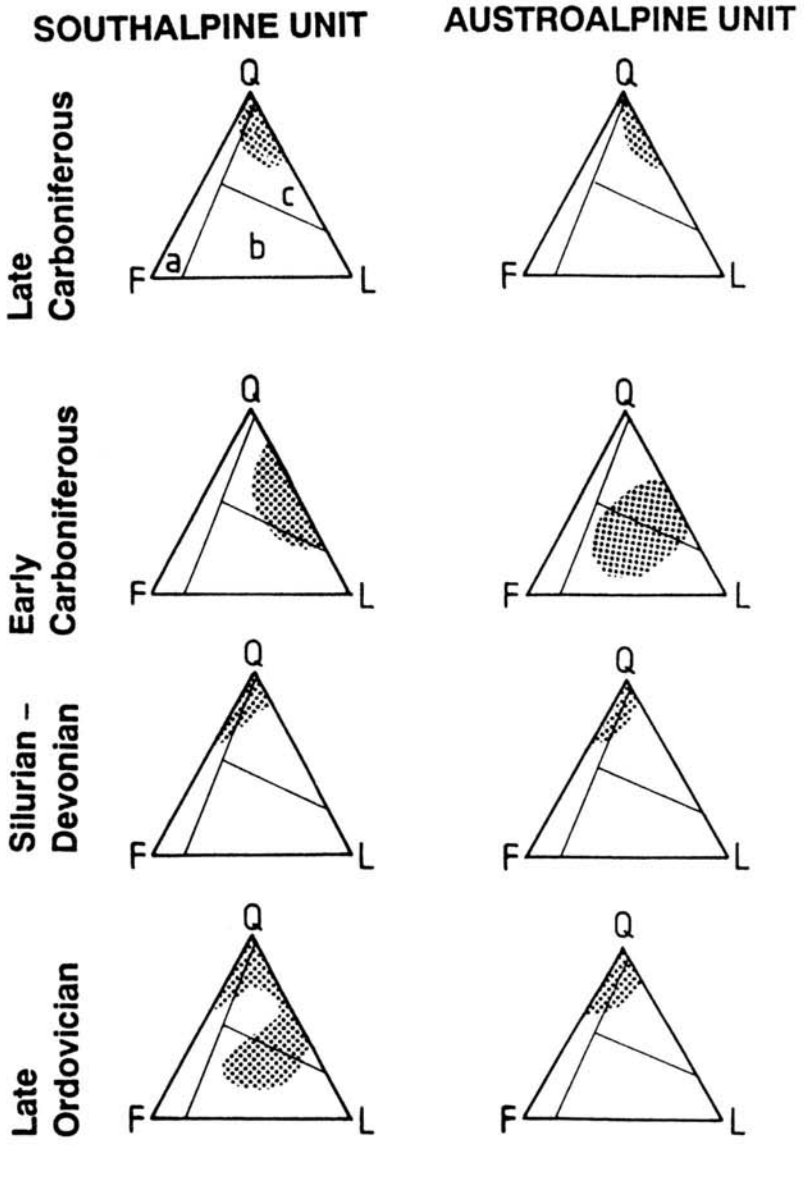

Fig.1. Compositional variations of Paleozoic sandstone through time. Q – mono- and polycrystalline quartz; F – feldspar; L – lithic fragments. Subdivision of fields according to Dickinson and Suczek (1979): a – basement uplift; b – magmatic arc; c recycled orogenic.

rift environment. Middle Devonian sandstones only occur within the PG, they are extremely rich in quartz and often reddish in color indicating possible relationships to the Old Red. Early Carboniferous sandstones occur within turbiditic clastic wedges of a foreland basin. These sandstones are rich in lithic, often acidic volcanic fragments which are interpreted to reflect magmatism within a continent-continent collision environment. Early Carboniferous acidic volcanics do not occur in present outcrop levels. Widespread granites may represent contemporaneous magmatic equivalents of these volcanic fragments. Late Carboniferous molasse-like overstep sequences record a rapid change from graywackes to quartz arenite with a significant amount (- 20 volume percent) of detrital muscovite. The compositional and textural maturity rapidly increased within Late Carboniferous.

In general terms, the determination of muscovite contents is a useful tool to distinguish quartz arenites from molasse-like overstep sequences from such of passive continental margins. We propose, therefore, to add the determination of muscovite contents to the commonly used DICKINSON-GAZZI method. Furthermore, rift environments are not represented in present versions of the DICKINSON-GAZZI method display similar modal compositions like arc environments.

THE ACKERL METAMORPHIC COMPLEX: A LATE VARISCAN METAMORPHIC NAPPE WITHIN THE AUSTROALPINE UNIT OF THE EASTERN ALPS

F. NEUBAUER[1], R.D. DALLMEYER[2]

1 Dept. of Geology and Paleontology, University, Hellbrunner Str. 34, A-5020 Salzburg, Austria

2 Dept. of Geology, University of Georgia, Athens / GA, 30602, USA

The Ackerl nappe forms a tectonic klippe representing the highest structural element within the Austroalpine nappe complex of the Eastern Alps. It constitutes, in ascending order, by the pre-Alpine Ackerl Micaschist Unit (AMU) and the Ackerl Gneis Unit (AGU) which are depositionally overlain by Permian to Triassic cover. Lithological relationships suggest that these basement units including the Alpine cover have been thrust from southern margins of the Austroalpine domain over at least 60 km over structurally deeper units of the Gurktal nappe complex.

The AMU mainly constitutes by metapelites including chloritic albite porphyroclast micaschists with a simple metamorphic history. Mineral parageneses are dominated by phengitic white mica, paragonite, quartz, albite, garnet, chloritoid indicating pressure-dominated upper greenschist facies during peak metamorphic conditions.

The AGU mostly contains a thick paragneiss pile with minor intercalations of amphibolites and deformed aplite. Lithological characteristics in the field, especially well-preserved mineralogical changes within decimetre-scaled layers suggest origin from graded turbiditic graywackes. Chemical (major, minor, trace elements including REE) and isotopic compositions ($^{87}Sr/^{86}Sr$ at 330 Ma b.p. as the minimum age of deposition: 0.7125-0.7191) of the paragneiss indicate an upper crust origin of these metasediments. Relatively high La_N/Yb_N ratios of amphibolite intercalations and missing respectively positive Eu*/Eu anomalies indicate an origin from both basaltic and gabbroic alkaline liquids. The paragneiss display a complex metamorphic history. The peak metamorphic conditions are within amphibolite facies conditions indicated by the mineral parageneses including quartz, plagioclase (oligoclase/albite), muscovite, biotite, garnet and staurolite.

The boundary between AMU and AGU is characterized by a ductile shear zone with well-preserved fabrics which were formed within upper greenschist facies metamorphic conditions. These fabrics are interpreted to correspond to the emplacement of the AGU nappe onto the AMU within middle levels of the crust.

Four concentrates of muscovite (each two of the AMU and AGU respectively) have been prepared in order to evaluate the minimum age of thrusting and of the subsequent cooling of AMU/AGU. All four argon isotopic release spectra display similar plateau-like characteristics at high temperature increments of the experiments with ages between 309 and 320 Ma (e.g., a plateau age of one AGU sample with 309.2±0.7 Ma: Fig. 1) and minor argon loss within low temperature increments with model ages younger than 200 Ma. We interpret these data to record late Variscan cooling of both AGU and AMU post-dating peak metamorphic conditions and a minor metamorphic overprint during Cretaceous reactivation during Alpine nappe stacking.