Tectonophysics 637 (2014) 305–327

Contents lists available at ScienceDirect

Tectonophysics

journal homepage: www.elsevier.com/locate/tecto

States of paleostress north and south of the Periadriatic fault: Comparison of the Drau Range and the Friuli Southalpine wedge

Esther Maria Bartel *, Franz Neubauer **, Johann Genser, Bianca Heberer

Dept. Geography and Geology, University of Salzburg, Hellbrunnerstr. 34, A-5020 Salzburg, Austria

ARTICLE INFO

Article history:
Received 19 May 2014
Received in revised form 16 October 2014
Accepted 22 October 2014
Available online 30 October 2014

Keywords:
Paleostress analysis
Orogenic wedge
Drau Range
Periadriatic fault
Southern Alps
Adriatic indenter

ABSTRACT

This study focuses on the analysis of structures and kinematics of a N–S profile along the axis of maximum shortening of the European Eastern Alps. The area includes the southern Austroalpine unit in the north and the Southalpine unit, which is a part of the Adriatic indenter. The stratigraphically different units are separated by the Periadriatic fault, the major strike-slip fault within the Alps. In order to assess the kinematics of these units, mainly fault-slip data from north and south of the Periadriatic fault were analyzed. We distinguish a succession of five main kinematic groups in both units: (1) N–S compression; (2) NW–SE compression; (3) NE–SW compression, σ_3 changes gradually from subvertical to subhorizontal; (4) N–S compression; and (5) NW–SE compression. Our study reveals that the deformation sequence on either sides of the PAF is similar. The mean orientations of the principal stress axes, however, show small, but consistent differences: The subhorizontal axes north of the Periadriatic fault plunge northward, in the south southward. A counterclockwise (CCW) rotation of the southern part in respect to the north is evident and in line with the well-known counterclockwise rotation of the Adriatic indenter as well as dextral displacement of the N-fanning stress-field along the Periadriatic fault. Opposing plunge directions are interpreted as a primary feature of the internal stress-field within an orogenic wedge further increased during ongoing compression.

1. Introduction

The Periadriatic fault (PAF) is the main strike-slip fault of the Alpine orogen and separates the Austroalpine unit and the indenting Southalpine unit in the Eastern Alps (Ratschbacher et al., 1991b; Schmid et al., 1989) (Fig. 1a). Both units belong to the Adriatic microplate sensu lato. Structural studies on fault systems (e.g. San Andreas fault, Zoback et al., 1987; Morez fault zone, Homberg et al., 1997) and 2-D distinct element modeling (Homberg et al., 1997) have shown, that stress fields may systematically rotate around subvertical axes in the vicinity of such major crustal discontinuities and stress deviations may occur next to weak zones where crustal deformation occurs. In this study, we pose the question whether the PAF represents an upper crustal stress perturbation, i.e. whether units on both sides of the PAF record similar or distinct stress patterns and/or whether block rotation overprinted the stress pattern.

The stratigraphical, structural and kinematic frameworks north and south of the right-lateral transpressional PAF differ significantly (e.g. Tollmann, 1977; Fig. 1b): The Southalpine units represent a S- to SE-verging fold-and-thrust belt. Between the PAF and the Fella–Sava Fault (Fig. 1) units are steeply dipping towards the south. Structures south of the PAF are well investigated (Brime et al., 2008; Läufer, 1996; Läufer et al., 2001; Rantitsch, 1997; Venturini, 1990). Austroalpine units within the study area north of the PAF are characterized by intense large-scale folding. Modern structural studies are scarce for the Austroalpine units north of the PAF, particularly for the Drau Range (DR) modern structural, kinematic and paleostress analyses are entirely missing. Paleomagnetic studies revealed largely similar counterclockwise (CCW) Neogene block rotations of about 20° in both the Austroalpine and Southalpine units (e.g. Márton et al., 2000; Mauritsch and Becke, 1987; Thöny et al., 2006), but no conclusive data are available from the study area itself.

We provide paleostress reconstructions for Southalpine and Austroalpine units N and S of the PAF based on a new dataset of brittle fault kinematics. In conjunction with a compilation of existing structural data, we first recognize how many tectonic events occurred and secondly reconstruct the stress trajectories. The studied transect is located at the tip of the Adriatic indenter across the central part of a straight segment of the PAF between the Giudicarie Fault in the west and the western Karawanken Mts. in the east (Fig. 1). We selected the study area because of (1) the supposedly strongest shortening at least in the Southalpine unit; (2) the straight segment of the Periadriatic fault where stress reorientation by changing external conditions like

* Corresponding author. Tel.: +43 6462 4888.
** Corresponding author. Tel.: +43 662 8044 5401.
E-mail addresses: bartel_esther@yahoo.de (E.M. Bartel), franz.neubauer@sbg.ac.at (F. Neubauer).

http://dx.doi.org/10.1016/j.tecto.2014.10.019

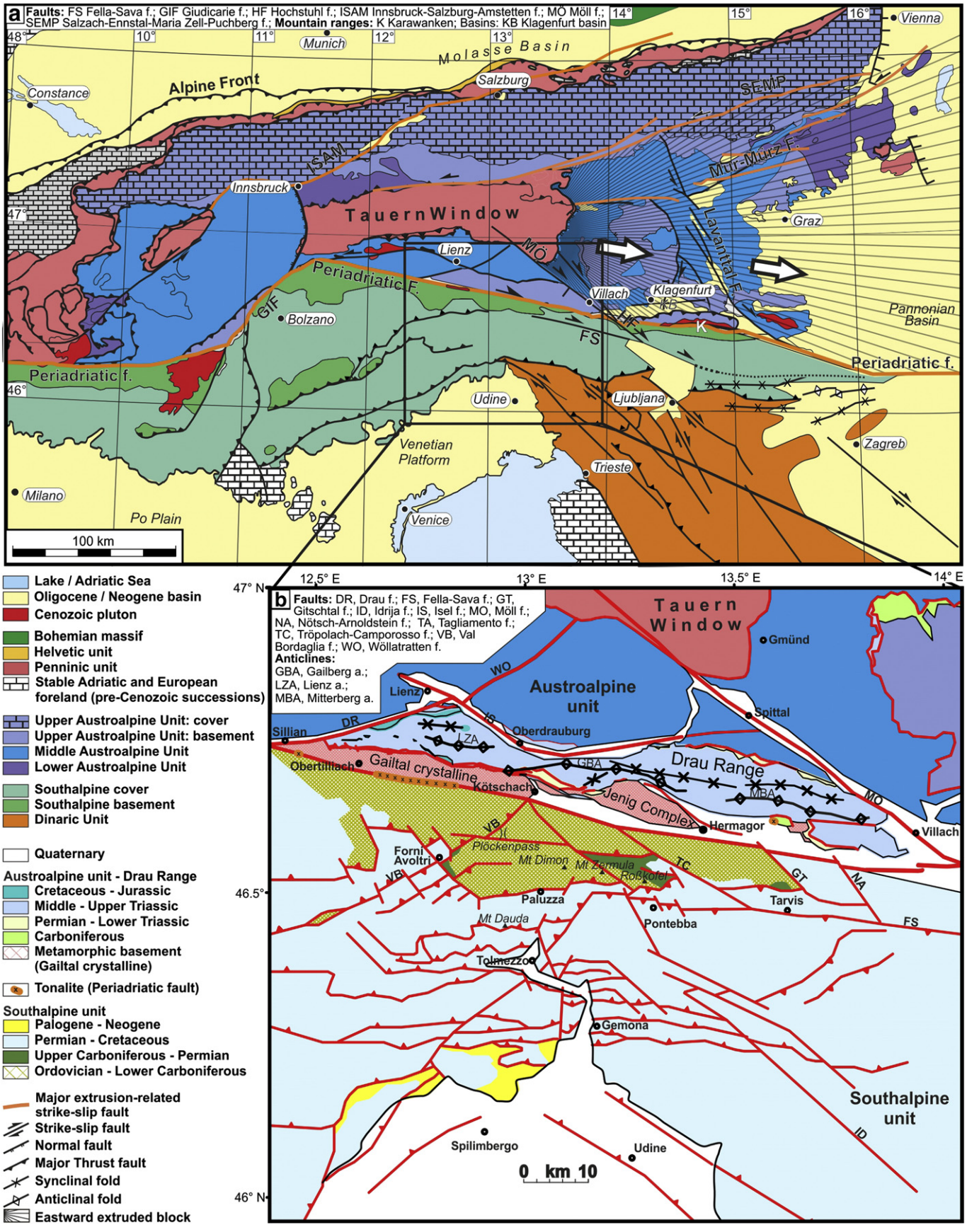

Fig. 1. (a) Simplified tectonic model of the Eastern Alps (modified after Egger et al., 1999; Neubauer and Höck, 2000; Plenicar, 2009) showing major ca. orogen-parallel sinistral and dextral strike-slip faults and resulting east-directed lateral extrusion of the central Eastern Alps. Black box denotes the extent of (b) study area.