Pergamon

PII: S0191-8149(80)00510-

Journal of Structural Geology, Vol. 20, No. 11, pp. 1579 to 1586, 1998

0191-8141/98 $ - see front matter

The kink-band triangle: a triangular plot for paleostress analysis from kink-bands

DEEPAK C. SRIVASTAVA

Department of Earth Sciences, University of Roorkee, Roorkee-247667, India

RICHARD J. LISLE

Laboratory of Strain Analysis, Department of Earth Sciences, University of Wales, Cardiff, CF1 3YE, U.K.

MOHD. IMRAN

National Council for Cement and Building Materials, New Delhi-110049, India

and

RAJEEV KANDPAL

Department of Earth Sciences, University of Roorkee, Roorkee-247667, India

(*Received* 28 *October* 1996; *accepted in revised form* 20 *May* 1998)

Abstract A kink-band can be graphically represented as a point on an equilateral triangle whose vertices define the angles between external foliation and kink plane, between internal foliation and kink plane, and between internal- and external-foliations. Four typical deformation paths that correspond to the four modes of kink-band growth can be discerned on this triangle. The three linear relationships between each of the kink-band angles and the inclination of the σ_1-axis with respect to the unrotated layering can be transformed into a straight line on the triangular plot. Application of this plot in paleostress analysis is demonstrated by several examples. The method, however, yields best results when a large number of data on the kink-band angles are plotted and contoured on the triangular graph. © 1998 Elsevier Science Ltd. All rights reserved

INTRODUCTION

Kink-bands assume geometrical characteristics according to their mode of growth (Twiss and Moores, 1992; Table 1). Of special significance here are the three angular parameters (kink-band angles) that constrain the geometry of a kink-band (Fig. 1). These are the angles between: (i) external foliation and kink plane (ϕ), (ii) internal foliation and kink plane (ϕ_k) and (iii) internal foliation and external foliation (ψ). The relationship between ϕ and ϕ_k angles has often been used as a criterion for deciphering the mode of kink-band growth (Ramsay, 1967; Anderson, 1968; Hobson, 1973; Gay and Weiss, 1974; Verbeek, 1978; Stewart and Alvarez, 1991).

Kink-bands are commonly used as paleostress indicators in rocks and their dynamic significance has been tested in several well constrained experimental studies (Paterson and Weiss, 1966; Donath, 1968; Anderson, 1974; Gay and Weiss, 1974). One common method of paleostress analysis from kink-bands involves bisecting the dihedral angles between the conjugate pairs of kink planes (Ramsay and Huber, 1987). The other method involves application of the experimentally determined relationships between each of the kink-band angles (ϕ, ϕ_k and ψ) and the inclination of the maximum compressive stress (σ_1-axis) with respect to the unrotated layering (Gay and Weiss, 1974). In this paper, we propose a new triangular plot as an improvement in the application of the second method and discuss its suitability in the paleostress analysis from contractional kink-bands (Ramsay and Huber, 1987).

TRIANGULAR PLOT

Geometry

By definition, the three kink-band angles (ϕ, ϕ_k and ψ) are related by an equation

$$\phi + \phi_k + \psi = 180°,$$

that implies the possibility of their representation on an equilateral triangle (Fig. 2). The angles ϕ, ϕ_k