experimental uncertainty; that is within about 1°. This suggests that the hypothesis is substantially correct and may be significant in accounting for the variable attitudes in natural en échelon systems.

Mass transport, fluid flow and foliation development.

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Several independent lines of evidence attest to the importance of mass transport over distances of tens of metres to kilometres during foliation development, especially at low metamorphic grades. The amount and distance of mass transport have profound implications for the transport process. In particular, diffusive transport via a standing fluid is unable to compete with advective solute transport in a mobile fluid. Additionally, the mass of solute moved during foliation development requires fluid volumes that are orders of magnitude too large for a single-pass system. We propose that a multiple-pass system is accomplished largely by thermal convection. Simple Rayleigh/Darcy modelling of a regional metamorphic terrain indicates that convection is feasible at permeabilities greater than 10^{-17} m^2. Permeability enhancement during deformation and metamorphism arises from grainscale and larger cracking, due largely to stress- and strain-rate incompatibilities at high fluid pressure, and to volumetric strains due to devolatilization reactions.

Since diffusion is not the rate-controlling transport process in this scenario, creep laws of unfamiliar form may apply during foliation development. We present one possible model in which deformation rate is controlled largely by the rate of fluid flow (i.e. by permeability and the advective driving force). This model has an unusual temperature dependence that may depart significantly from the usual Arrhenius form.

The geometry and role of normal faulting in sedimentary basin development.

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Lithospheric extension is a key process in basin formation, and it generally results in normal faulting in the upper crustal floor to the sedimentary sequence. The geometry of such faults provides a most important constraint on the kinematics of the crustal deformation accompanying basin formation, and is therefore a key element in thermal and subsidence modelling. The geometry of extensional normal faulting has recently been treated in some detail, and this paper concentrates on the following specific aspects.

(1) All forms of rotational normal faulting demand substantial penetrative deformation of the fault blocks, especially at moderate to large extensions. Consideration of the geometry of undeformable models of the planar and circular listric end-members indicates that the latter requires considerably more penetrative deformation per unit extension, and that the planar or 'domino' style may therefore be energetically favoured.

(2) Calculation of extensional strain from the geometry of planar normal faults is straightforward. However, in the listric case, the computed extension is dependent on the manner in which the penetrative deformation is accomplished. It is shown that a previous model, in which extension by listric faulting is substantially less than that by planar faulting, is not broadly applicable. In fact, for $\beta > 1.5$, the computed extensions for planar or a more realistic listric model are very similar, and the block-top geometry method used for planar rotational faults is broadly applicable to curved fault geometries.

(3) Mechanical, thermal and subsidence modelling of sedimentary basins require an accurate kinematic framework, and this is best provided by the major fault geometry. Two seismic sections from the BMR 1982 Bass Strait Seismic Survey illustrate a number of simple kinematic principles that need to be taken into account when interpreting such sections and modelling sedimentary basin formation.

Problems of volume loss, fabric development and strain determination in low-grade pelitic rocks: Martinsburg Formation, U.S.A.

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Determination of volume changes in deformed rocks is problematic and has led to controversy about volume-loss vs constant-volume deformation models for cleavage development in low-grade pelitic rocks. Most determinations have involved chemical analysis, although a simpler more efficient method uses graptolites on bedding surfaces. The effect of volume loss in strain analyses in slates is another closely related problem, since most strain gauges cannot discriminate between volume-loss and constant-volume processes.

These combined problems have been confronted within a belt of Martinsburg shale in the Great Valley of northern Virginia and Pennsylvania. This belt shows ubiquitous development of a spaced slaty cleavage. The rocks contain both graptolites and pressure-fringes on framboidal pyrites. Preliminary comparison of strain data from both markers suggests that where principal extensions are low, volume losses due to pressure dissolution are high. Similarly, where principal extensions are higher, volume losses appear lower. Volume losses up to 50% occur in some parts. Chlorite fibre-growth patterns on the pyrite require either plane strain or constriction. Morphologically similar hand specimens from widely separated geographical locations show markedly different partitioning of strain. This requires different deformation mechanisms at the grain scale and suggests varying contributions of these along the strike of the belt during cleavage development.

Boudinage and tension fracturing during bulk simple shearing.

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Field and experimental studies of boudinage and tension fracturing during bulk simple shearing have shown that boudin necklines and tension fractures may develop at an oblique angle to the maximum extension directions. Boudins are displaced along shear bands of normal fault geometry consistent with the bulk sense of shearing. Minor conjugate shear bands, along which normal movement takes place, of opposite sense to the bulk shearing are also developed at an early stage between boudins.

Progressive and polyphase deformation of the Schistes Lustrés in Cap Corse, Alpine Corsica.

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In Cap Corse, progressive deformation during Late Cretaceous obduction of the ophiolitic Schistes Lustrés (*sensu lato*) as a pile of imbricate, lens-shaped units during blue-schist facies metamorphism is non-coaxial. Two zones are recognized: a lower series emplaced towards the W is overlain by a series emplaced towards the SSW in western Cap Corse. Equivalent structures (differing only in orientation) occur in both zones. The change in thrust direction is responsible for local refolding and reorientation of previously formed structures parallel to the new stretching direction immediately below the thrust contact between the two zones and within localized shear zones in the underlying series.

Both zones are refolded about E-overturned F_2 folds trending between 350 and 025°. Local minor E-directed thrusts occur associated with F_2 folds. This second deformation of Middle Eocene age is considered to be related to the backthrusting of an overlying klippe containing gneisses of South Alpine origin, and is followed by a third Late Eocene phase of upright 060°-trending F_3 folds accompanied by greenschist facies metamorphism.

Influence of basement structures, pore fluids, and stress refraction on en échelon veins, Burdekin region, Queensland.

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