INCIPIENCE OF TECTONIC FAULTING: CONTINUUM MECHANICS VERSUS FRACTURE MECHANICS
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Tectonic faulting in the brittle crust of the Earth proceeds in very narrow zones. Geologists have been interested in these processes as they apply to the development of large elastic fracture mechanics (EFM) and, more recently, efforts have increased to model also the fault growth of tectonic faults as a quasielastic or dynamic growth of a single crack in a pre-existing elastic environment.

Contrary to this approach, the modelling of fault formation as a continuous aseismic process of shear crack initiation in an aseismic frictional plastic material accounts for the fault that - apart from special circumstances - is a fault that is preceded by irreversible change of the rock in a way that is quasi-fracture formation.

The paper presents an example of a cooperative evaluation of the two appraoches.

FLUID CIRCULATION, GEOCHEMICAL MASS TRANSFER AND PROGRESSIVE DEFORMATION IN THE UPPERMOST CRUST: EXAMPLE OF BASEMENT-COVER RELATIONSHIPS IN THE EXTERNAL CRYSTALLINE MASSIFS, CENTRAL ALPS, SWITZERLAND
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This external zone of the Swiss Alps is composed of sedimentary cover (Pliensbachian to Tertiary sandstone) and pre-existing crystalline basement (External crystalline massifs). The current part of this model comprises a series of overlapping and westwardly directed thrusts which form the two crystalline units. The fluid interactions between basement cover are analyzed using stable isotope systems. With these data sets, the variation of geothermal gradients and major structures (lithostratigraphy or strain) show two types of behavior:

1) Closure of structural models of both components could be associated with vertical formation in the heaved cover. Variations of δ18O reflect the chemical homogeneity of which the fluid composition is a geologic event, and show increase then decrease as the same way in the profile (e.g., δ18O KC), this fact agrees to the input volume gain and crust along the profile for each profile.

2) Open system variation profiles in cover, mylonites show continuous isotope of δ18O decrease and δ18O approaching values close to those of basement in the crystalline massif. In glacial, the same continuous evolution can be described for decrease of δ18O and increase of KC.

For the basement-cover relationship in the upper crust is a two-step process, and geochronologic model is proposed.

1) A progressive evolution of crustal instability is controlled by the propagation of mechanical instabilities in a solid crust and (ii) with increasing deformation, an intergranular process where shear zones becomes available and permit a quantified fluid circulation and mass transfer in an open system, fluid sources and transport mechanisms of chemical elements.

CYCLIC DEFORMATION AND FLOW INSTABILITIES IN THE NUCLEATION OF THE VILAIRE STRIKE-SLIP FAULT, NE PORTUGAL
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The Vilaíra fault zone (VFZ) is a 75 km long, NNE-SSW, zone of left-lateral displacement, generated in late Variscan times. It was nucleated in the D3 Monserrate-Vila Real granite batholith of intra-Westphalian age, during the late stage of its emplacement (when high-temperature pegmatites were still molten). The multiple deformation events responsible for the VFZ nucleation produced a cyclic and heterogeneous reorganization of grain accommodation in granitic rocks and pegmatite veins, as suggested by the synformal/hemiformal sinistral, temporal, cyclicity and spatial coexistence of plastic-brittle microstructures. Strain heterogeneity is favored by the development of mechanical instabilities at the microscale, mainly from: (i) plastic flow reorganization of dynamic (reactive flow and dynamic reorganization) reorganization of dynamic instabilities (diapiric) act upon various minerals, for each set of P T conditions; (ii) initiation and quasi-static propagation of intergranular cracks, specially those containing the late cored faulting and subsequent chemical softening of the foliation; (iii) strain features linked with grain-boundary mechanisms, such as the sub-critical propagation of collateral intra-crystalline cracks. The precipitation of fluid-assisted processes in the quasi-static growth of microstructures suggests that stress corrosion is due to other time-dependent cracking processes during the stress cycling associated with the nucleation cycle of the VFZ. Furthermore, the cyclic yielding of these structural discontinuities might have enabled sustained increases in fluid pressure and, therefore, contributed decisively to the critical damage level of the granitic rocks. Thus, the deformation might have involved long periods of time at low stress, accentuated by interferences short-wavelength, high-amplitude internal instabilities, the significant fluid inflow.

ON THE FORMATION OF THE TIBETAN PLATEAU
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The Tibet plateau, the world's highest surface, steadily rising from the Himalaya to the South to the Aynsh Tagh fault to the North. The age of elevation of this plateau has been interpreted in terms of either (1) the isostatic movement of the high-altitude plateau oceanic crust, or (ii) the superposition of two normal crusts, one underneather Asia, permitting a 70 km crustal thickening. None of these models can explain the fracturing seismic profile across the southern half of the plateau that gives evidence for marked offsets of the Moluo boundary. The several kilometers offsets have a periodic occurrence of about 100 km.

The 100-km periodicity suggests that the Tibetan plateau results from the growth of a mechanical instabilizer with a regular wavelength. We associate the growth and amplification of this instability to the N-S subduction system, fluid sources and transport mechanisms of chemical elements.