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Chapter 1 : Earth & Environmental Sciences (Mineralogy) Home Page

*STRUCTURAL MINERALOGY OF CLAYS By GEORGE W. calendrierdelascience.com * INTRODUCTION The investigation of clay minerals utilizing X-ray crystallograpliie techniques has been very actively purÂ-.*

General purpose stereographic projection program for plotting lines, planes, density contouring, rotations, etc. General purpose cross section forward modeling program for fault-bend folds, trishear fault-propagation folds, and listric or planar normal faults. A section can have up to 30 faults, either listric or planar, and folding over ramps can occur either by parallel or similar folding. Simulates pure and simple shear deformation of boxes, triangles, circles, and lines. Calcite, dolomite, and quartz microstructure analysis; includes Groshong strain gauge. Plots frictional-crystal plastic transition curves. Simple stratigraphic column construction from tape or jacob staff. Several programs for structural geology from Nestor Cardozo. It operates on lines and planes, strains, and stresses. Multiple computations can be performed using text files. Lines and planes can be visualized in a Stereonet. OSXGeoCalc was made for geologists, but it can be used by anyone who is interested in planes and lines, strains, and stresses physicists, engineers, geotechnicians, etc. Backstripping is not a difficult task but it is tedious. OSXBackstrip makes backstripping enjoyable. Trishear3D is a program to run 3D trishear models. OSXFlex2D is a program that implements the "elastic", "flexural" model of the displacement profile of the surface of the earth under crustal loads i. It has several templates, including ones for mineralogy, petrology, sedimentology and paleontology, along with blank templates. GAEA Technologies has several programs available for borehole and well data, contaminant migration and grain size analysis. The free demos are fully functional except that they will print "DEMO" in large letters on the outputs and they are restricted to a maximum of 20 new logs or cross-sections. Image can acquire, display, edit, enhance, analyze and animate images. It supports many standard image processing functions, including contrast enhancement, density profiling, smoothing, sharpening, edge detection, median filtering, and spatial convolution with user defined kernels. Image can be used to measure area, mean, centroid, perimeter, etc. It also performs automated particle analysis and provides tools for measuring path lengths and angles. Spatial calibration is supported to provide real world area and length measurements. Density calibration can be done against radiation or optical density standards using user specified units. Results can be printed, exported to text files, or copied to the Clipboard. Noddy 3D Geological and Geophysical Modelling System The Noddy modelling system allows you to rapidly build complex 3D geological models and calculate the resulting gravity and magnetic fields. Its primary use in in teaching, although of course it does allow you to try out simply geological scenarios as well. This collection includes the following programs: Theriak, the heart of the collection, calculates the stable mineral assemblage and phase compositions for a given rock bulk composition at specified P,T conditions. Domino may calculate a equilibrium assemblage diagrams with selectable axes P, T, components activity and logarithms of components activity , b Pseudo-binary or pseudo-ternary phase diagrams, c Phase compositional isopleths as well as density, volume or modal amount distributions; d Distribution of rock bulk parameters. Thalia and Thermo calculate the phase or assemblage dependence of thermodynamic parameters on T or P or binary composition.

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This new classification may be considered as an extension of the structural classification of silicates, to the complete domain of minerals. A complete and well organized overview of mineral structure types comprizing the more common minerals is presented in chart form.

Similarly, faulted and structurally complex areas are notable as permeable zones for hydrothermal fluids, resulting in concentrated areas of base and precious metal ore deposits. Veins of minerals containing various metals commonly occupy faults and fractures in structurally complex areas. These structurally fractured and faulted zones often occur in association with intrusive igneous rocks. They often also occur around geologic reef complexes and collapse features such as ancient sinkholes. Deposits of gold , silver , copper , lead , zinc , and other metals, are commonly located in structurally complex areas. Structural geology is a critical part of engineering geology , which is concerned with the physical and mechanical properties of natural rocks. Structural fabrics and defects such as faults, folds, foliations and joints are internal weaknesses of rocks which may affect the stability of human engineered structures such as dams , road cuts, open pit mines and underground mines or road tunnels. Geotechnical risk, including earthquake risk can only be investigated by inspecting a combination of structural geology and geomorphology. In addition, areas of steep slopes are potential collapse or landslide hazards. Environmental geologists and hydrogeologists need to apply the tenets of structural geology to understand how geologic sites impact or are impacted by groundwater flow and penetration. For instance, a hydrogeologist may need to determine if seepage of toxic substances from waste dumps is occurring in a residential area or if salty water is seeping into an aquifer. Plate tectonics is a theory developed during the s which describes the movement of continents by way of the separation and collision of crustal plates. It is in a sense structural geology on a planet scale, and is used throughout structural geology as a framework to analyze and understand global, regional, and local scale features. Geometries[edit] Primary data sets for structural geology are collected in the field. Structural geologists measure a variety of planar features bedding planes , foliation planes , fold axial planes, fault planes , and joints , and linear features stretching lineations, in which minerals are ductily extended; fold axes; and intersection lineations, the trace of a planar feature on another planar surface. Illustration of measurement conventions for planar and linear structures Measurement conventions[edit] The inclination of a planar structure in geology is measured by strike and dip. The strike is the line of intersection between the planar feature and a horizontal plane, taken according to the right hand convention, and the dip is the magnitude of the inclination, below horizontal, at right angles to strike. Alternatively, dip and dip direction may be used as this is absolute. Dip direction is measured in degrees, generally clockwise from North. Note that this is the same as above. The term hade is occasionally used and is the deviation of a plane from vertical i. Fold axis plunge is measured in dip and dip direction strictly, plunge and azimuth of plunge. The orientation of a fold axial plane is measured in strike and dip or dip and dip direction. Lineations are measured in terms of dip and dip direction, if possible. Often lineations occur expressed on a planar surface and can be difficult to measure directly. In this case, the lineation may be measured from the horizontal as a rake or pitch upon the surface. Rake is measured by placing a protractor flat on the planar surface, with the flat edge horizontal and measuring the angle of the lineation clockwise from horizontal. The orientation of the lineation can then be calculated from the rake and strike-dip information of the plane it was measured from, using a stereographic projection. If a fault has lineations formed by movement on the plane, e. Plane, fabric, fold and deformation conventions[edit] The convention for analysing structural geology is to identify the planar structures, often called planar fabrics because this implies a textural formation, the linear structures and, from analysis of these, unravel deformations. Planar structures are named according to their order of formation, with original sedimentary layering the lowest at S0. Often it is impossible to identify S0 in highly deformed rocks, so numbering may be started at an arbitrary number or given a letter SA, for instance. In cases where there is a bedding-plane foliation caused by burial metamorphism or diagenesis this may be enumerated as S0a. If there are folds, these are numbered as F1, F2, etc. Generally the axial plane foliation or cleavage of a fold is created during folding, and the number convention should match. For example, an F2 fold should have an S2 axial foliation. Deformations are numbered according to their order of formation with the letter D denoting a deformation event. For example, D1, D2, D3. Folds and foliations, because they are formed by deformation events, should correlate with these events. For example, an F2 fold, with an S2 axial plane foliation would be the result of a D2 deformation. Metamorphic events may span multiple deformations. Sometimes it is useful to identify them similarly to the structural features for which they are responsible, e. This may be possible by observing porphyroblast formation in cleavages of known deformation age, by identifying metamorphic mineral assemblages created by different events, or via geochronology. Intersection lineations in rocks, as they are the product of the intersection of two planar structures, are named according to the two planar structures from which they are formed. For instance, the intersection lineation of a S1 cleavage and bedding is the L intersection lineation also known as the cleavage-bedding lineation. Stretching lineations may be difficult to quantify, especially in highly stretched ductile rocks where minimal foliation information is preserved. Where possible, when correlated with deformations as few are formed in folds, and many are not strictly associated with planar foliations , they may be identified similar to planar surfaces and folds, e. For convenience some geologists prefer to annotate them with a subscript S, for example Ls1 to differentiate them from intersection lineations, though this is generally redundant. Stereographic projections[edit] Stereographic projection is a method for analyzing the nature and orientation of deformation stresses, lithological units and penetrative fabrics wherein linear and planar features structural strike and dip readings, typically taken using a compass clinometer passing through an imagined sphere are plotted on a two-dimensional grid projection, facilitating more holistic analysis of a set of measurements. Rock macro-structures[edit] On a large scale, structural geology is the study of the three-dimensional interaction and relationships of stratigraphic units within terranes of rock or geological regions. This branch of structural geology deals mainly with the orientation, deformation and relationships of stratigraphy bedding , which may have been faulted, folded or given a foliation by some tectonic event. Study of regional structure is important in understanding orogeny , plate tectonics and more specifically in the oil, gas and mineral exploration industries as structures such as faults, folds and unconformities are primary controls on ore mineralisation and oil traps. Further information from geophysics such as gravity and airborne magnetics can provide information on the nature of rocks imaged to be in the deep crust. Textural study involves measurement and characterisation of foliations , crenulations , metamorphic minerals, and timing relationships between these structural features and mineralogical features. Usually this involves collection of hand specimens, which may be cut to provide petrographic thin sections which are analysed under a petrographic microscope. Microstructural analysis finds application also in multi-scale statistical analysis, aimed to analyze some rock features showing scale invariance see e. Kinematics[edit] Geologists use rock geometry measurements to understand the history of strain in rocks. Strain can take the form of brittle faulting and ductile folding and shearing. Brittle deformation takes place in the shallow crust, and ductile deformation takes place in the deeper crust, where temperatures and pressures are higher. Stress fields[edit] By understanding the constitutive relationships between stress and strain in rocks, geologists can translate the observed patterns of rock deformation into a stress field during the geologic past. The following list of features are typically used to determine stress fields from deformational structures.

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Chapter 5 : American Mineralogist Crystal Structure Database

The structural classification of minerals. J. Lima-De-Faria. Pages The anatomy of crystal structures. J. Lima-De-Faria. Pages The architecture of crystal.

Chapter 6 : Isostructural - Wikipedia

Structural Mineralogy: an Introduction. [J Lima-De-Faria] -- This work presents a novel pure structural classification of minerals, based on the minerals' internal structure. In more detail, it is based on the strength distribution and directional character of.

Chapter 7 : Structural geology - Wikipedia

Provides a structural classification of minerals, based on the minerals' internal structure. This work is based on the strength distribution and directional character of the bonds. It presents an overview of mineral structure types comprizing the more common minerals in chart form.

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Structural geology is the study of the three-dimensional distribution of rock units with respect to their deformational histories. The primary goal of structural geology is to use measurements of present-day rock geometries to uncover information about the history of deformation (strain) in the rocks, and ultimately, to understand the stress.