University of Anbar

College of Science

Department of Applied Geology

Structural Geology Title of the lecture Faults

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Faults

Faults: Brittle fractures along which measurable displacement has occurred

Fault zones: Displacement on several brittle surfaces within a definable width.

Shear zones: Ductile structures along which displacement occurs without mesoscopic loss of cohesion.



Fault Dip Geometry and Angles:

1. Listric fault: concave up that has a steep dip close to the earth' surface and has a shallow dip at depth.



2. planar



Shallow $< 30^{\circ}$

Moderate 30° - 60° .

Steep $> 60^{\circ}$

3. Anastomosing



Fault block description for non-Vertical faults:



Types of faults depend on sense of displacement

1. Dip-Slip Faults

Normal fault: hanging wall block slip downward related to footwall block.



Reverse Fault: hanging wall block slip upward related to footwall block.



2. Strike-Slip Faults

Dextral Fault or right lateral strike slip fault: right block slip toward the viewer.



Sinistral Fault or left lateral strike slip fault: left block slip toward the viewer.



3. Oblique-Slip Faults

Transtension



Transpression



Principal stress axes:

There are three types of principal stress axes σ_1 , σ_2 and σ_3 . Two of them are horizontal and the third is vertical.

 \circ_1 axis of maximum principal stress that bisects the acute angle between the conjugate shear fractures

 σ_2 axis of intermediate principal stress that defined by the intersection of a pair of conjugate shear fractures

 \circ_3 axis of minimum principal stress that bisects the obtuse angle between the conjugate shear fractures.

Anderson classification of Faulting:

Normal Faults:



 $\sigma_{3 \text{ bisects the obtuse angle}}$



Reverse Faults:

 $\boldsymbol{\sigma}_{3 \text{ is vertical,}} \boldsymbol{\sigma}_{1 \text{ and }} \boldsymbol{\sigma}_{3 \text{ are horizontal.}}$

 σ_1 bisects the acute angle



Strike slip fault Faults:

 $\sigma_{2 \text{ is vertical, s}} \sigma_{1 \text{ and }} \sigma_{3 \text{ are horizontal.}}$

 $\sigma_{3 \text{ bisects the obtuse angle}}$



Fault Displacement Terms-

Net Slip: distance between 2 originally contiguous points, offset by faulting.

Dip slip component and strike slip component



References

Ben A. van der Pluijm, and Stephen Marshak. (2004) EARTH STRUCTURE AN INTRODUCTION TO STRUCTURAL GEOLOGY AND TECTONICS. Second edition.