

Fault Geometry

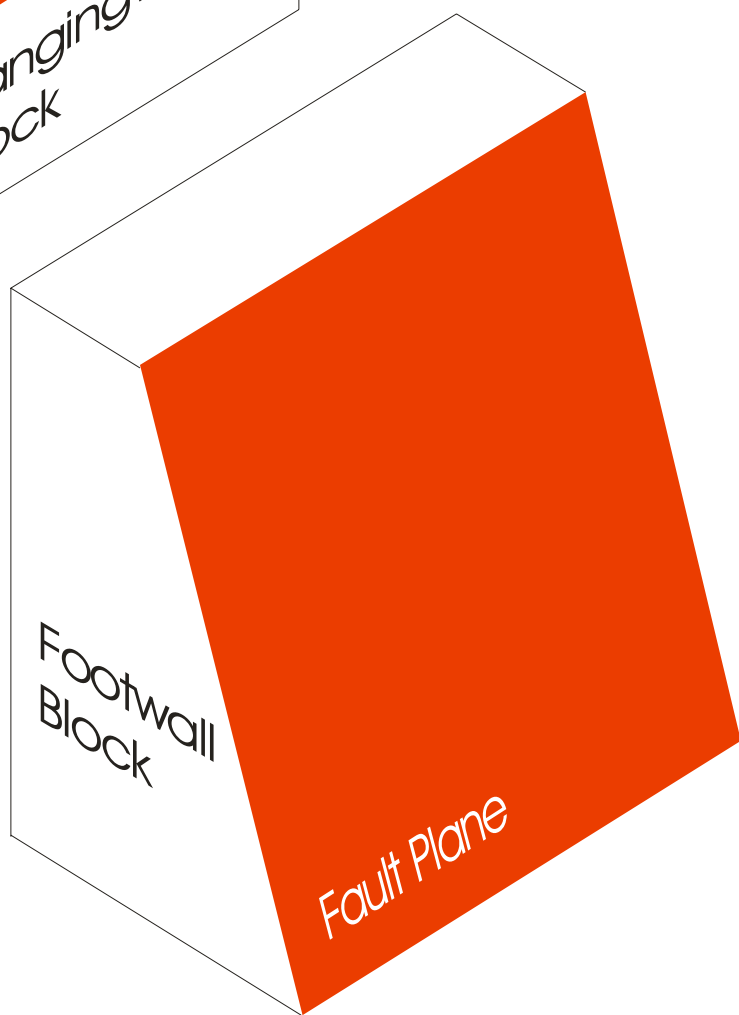
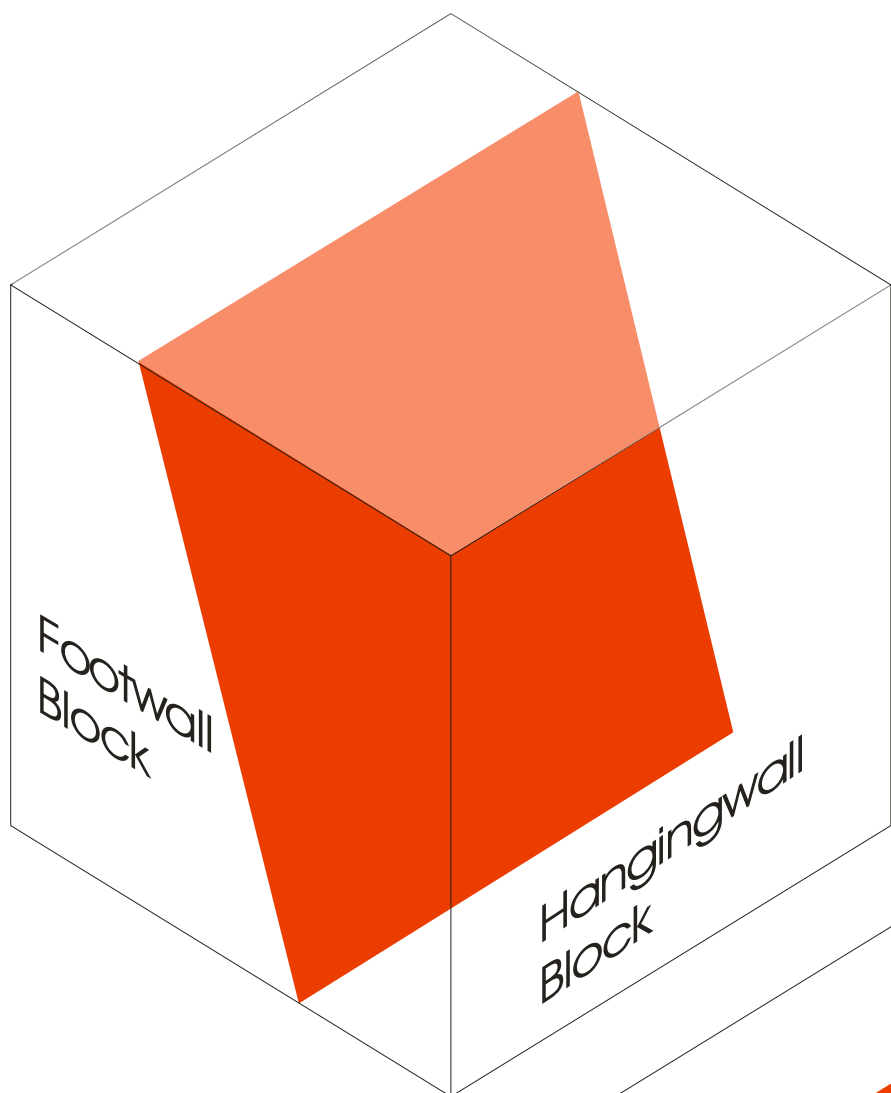
What is a Fault?

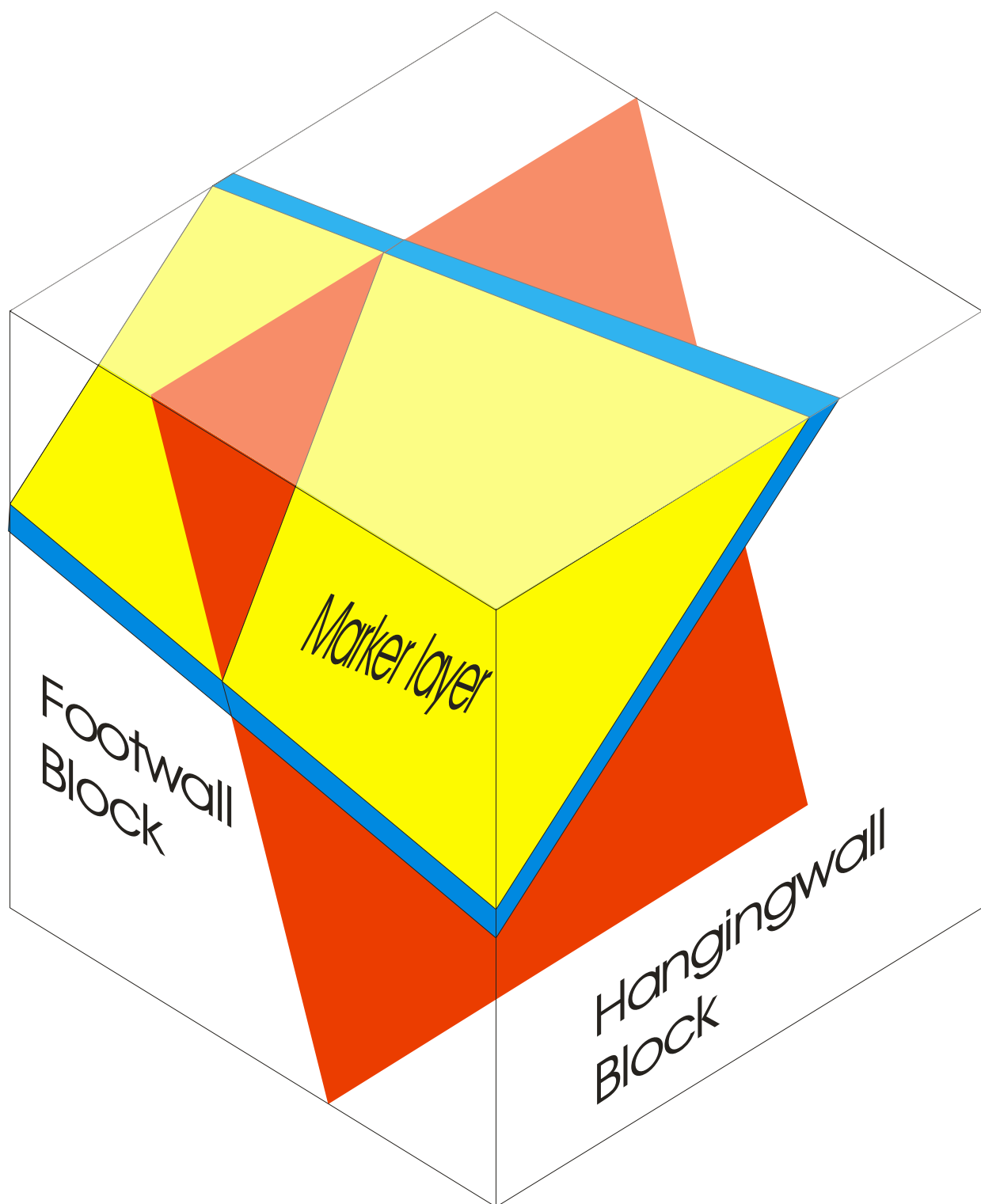
- A fracture across which there is noticeable shear displacement.

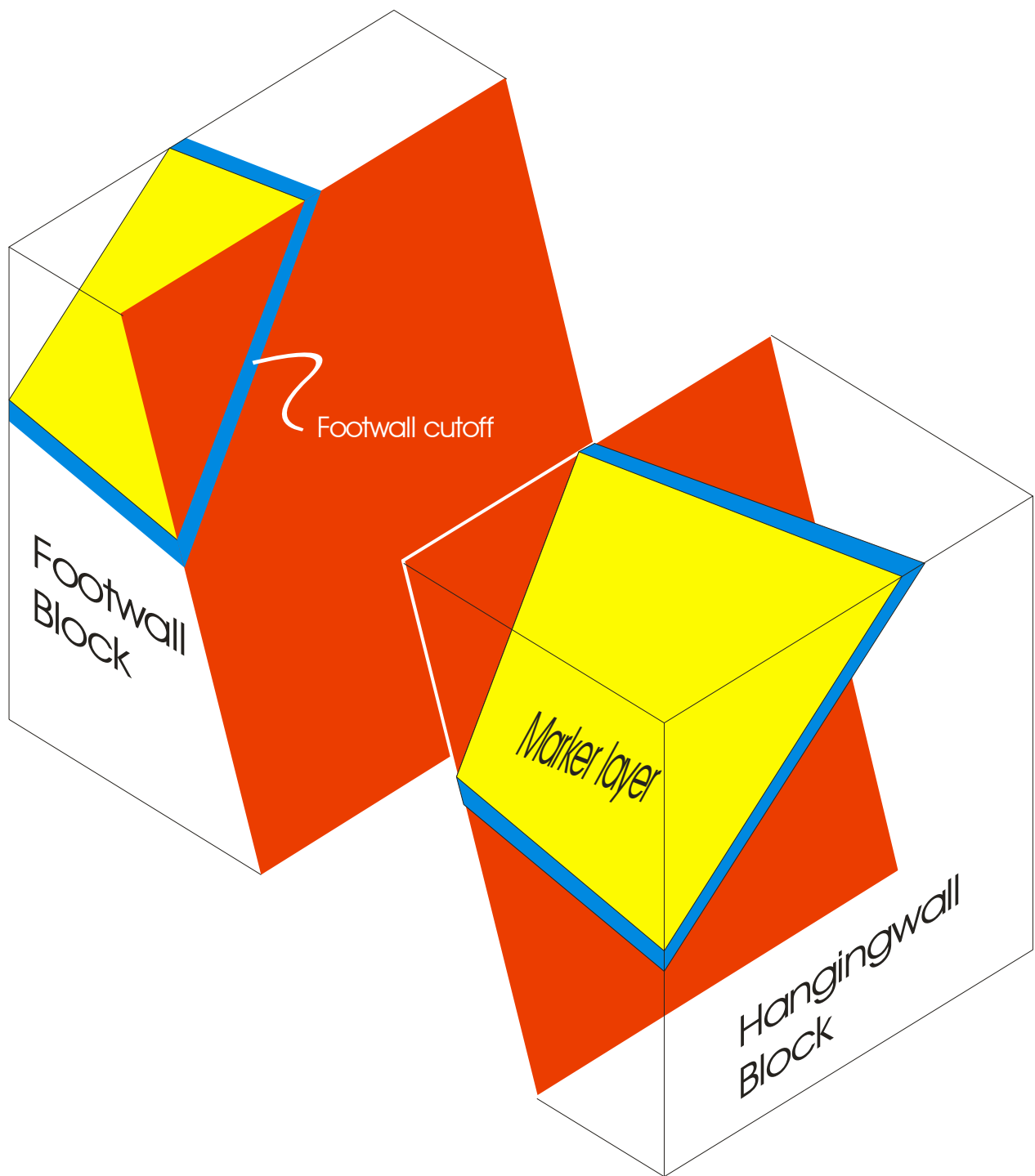
In the simplest situation, one can imagine a fault as a geometrical plane separating the rock mass into two blocks, a hanging wall and a foot wall.

- **Fault zones:**
 - Rarely are faults single surfaces; they are narrow zones of fractured rocks .

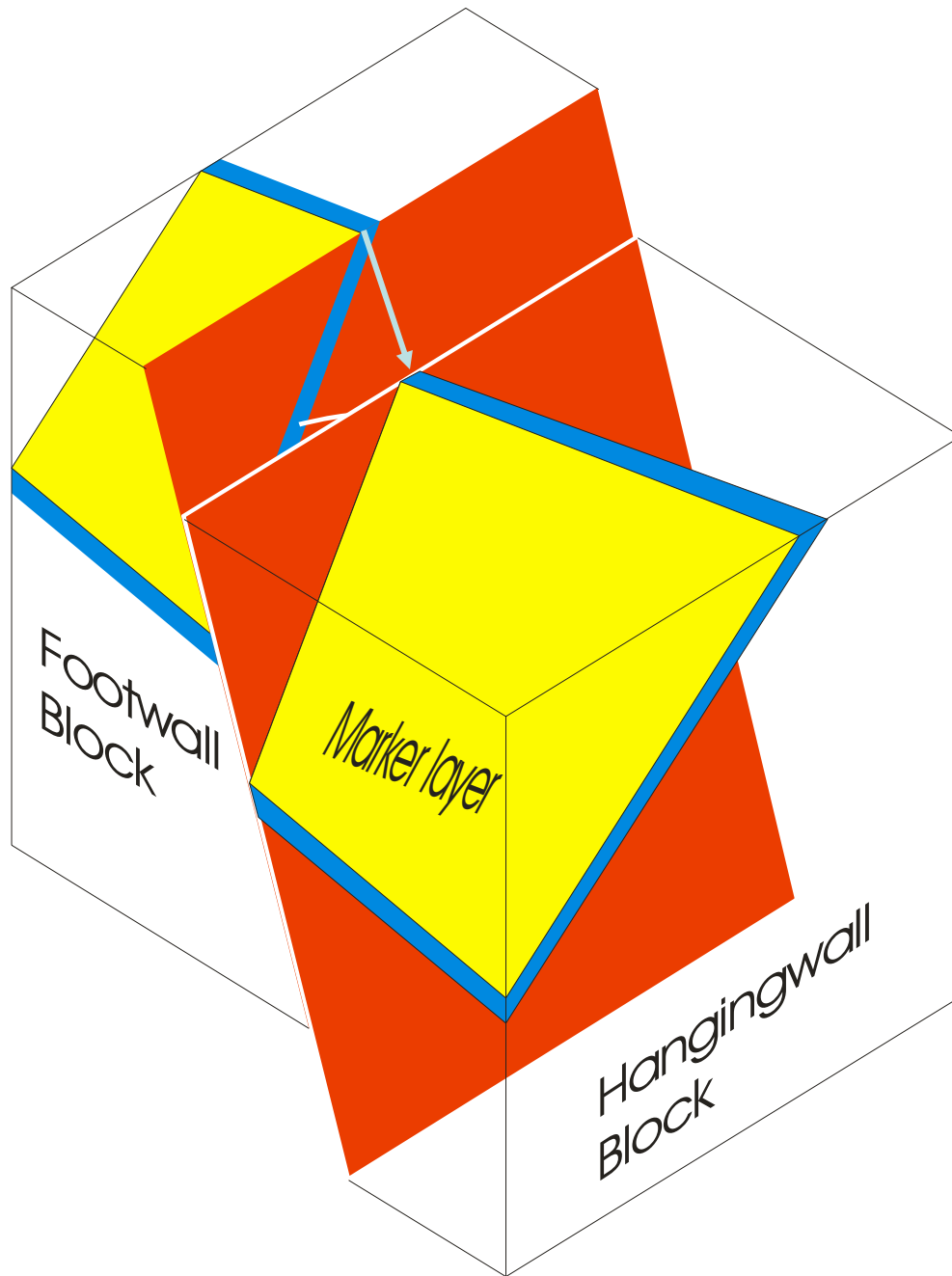




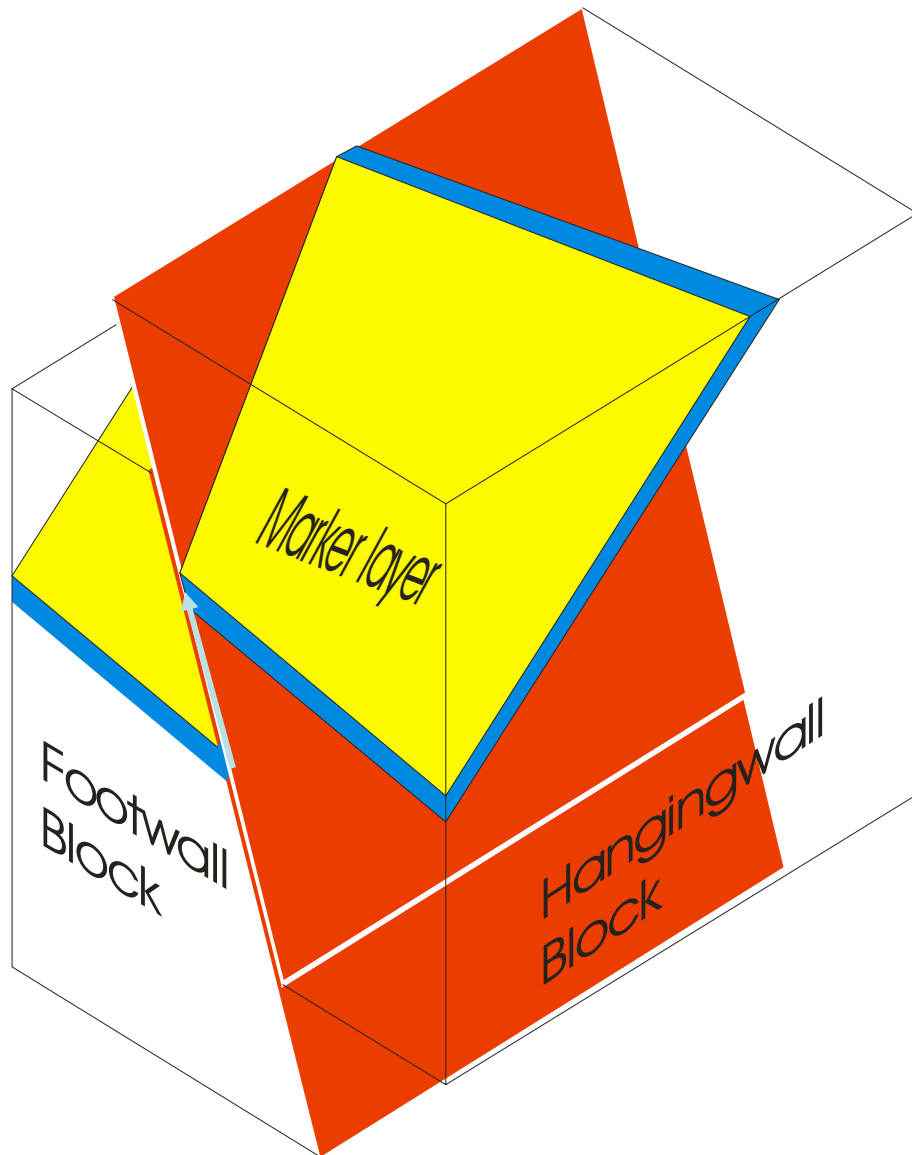




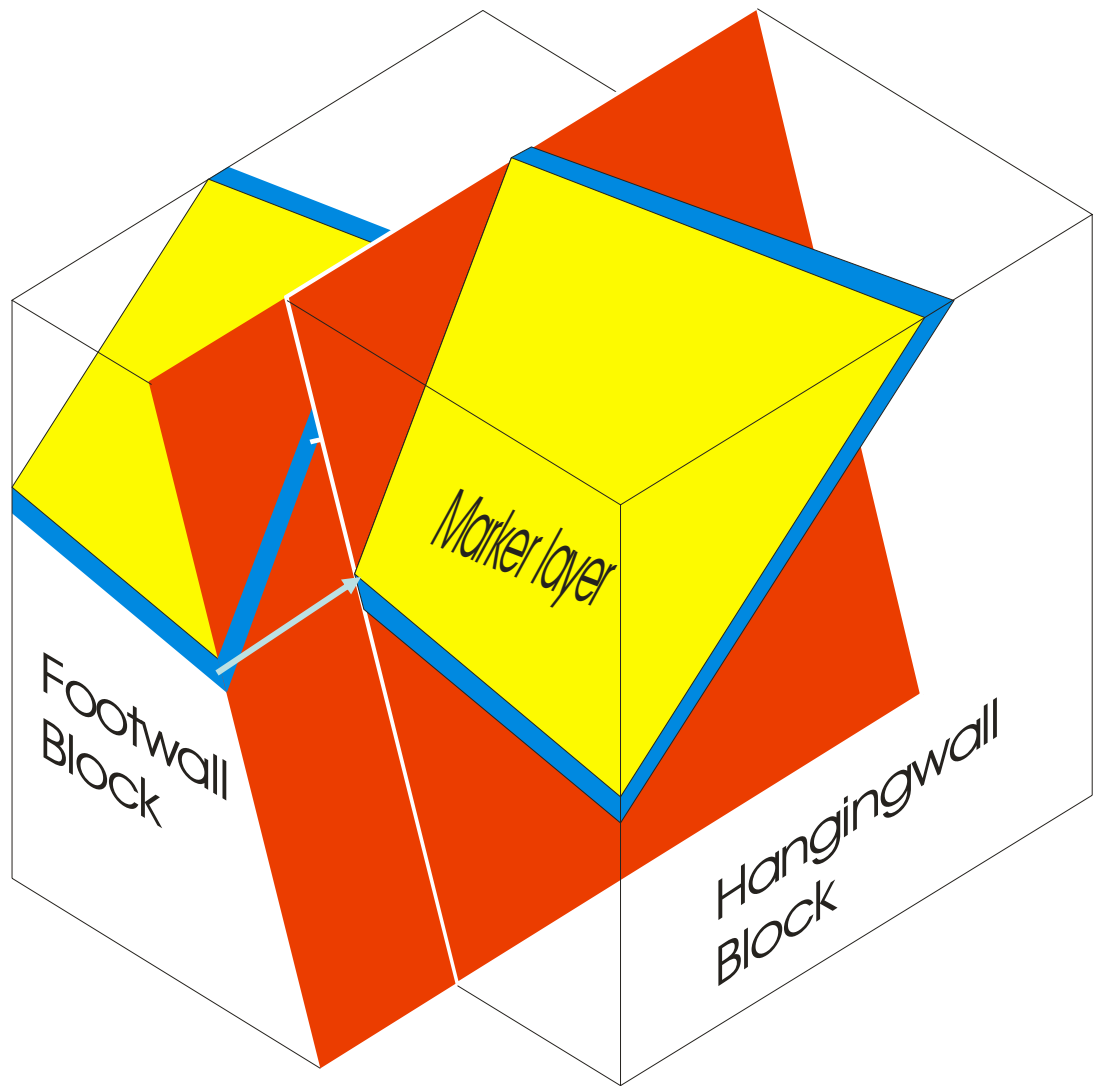
Normal Fault



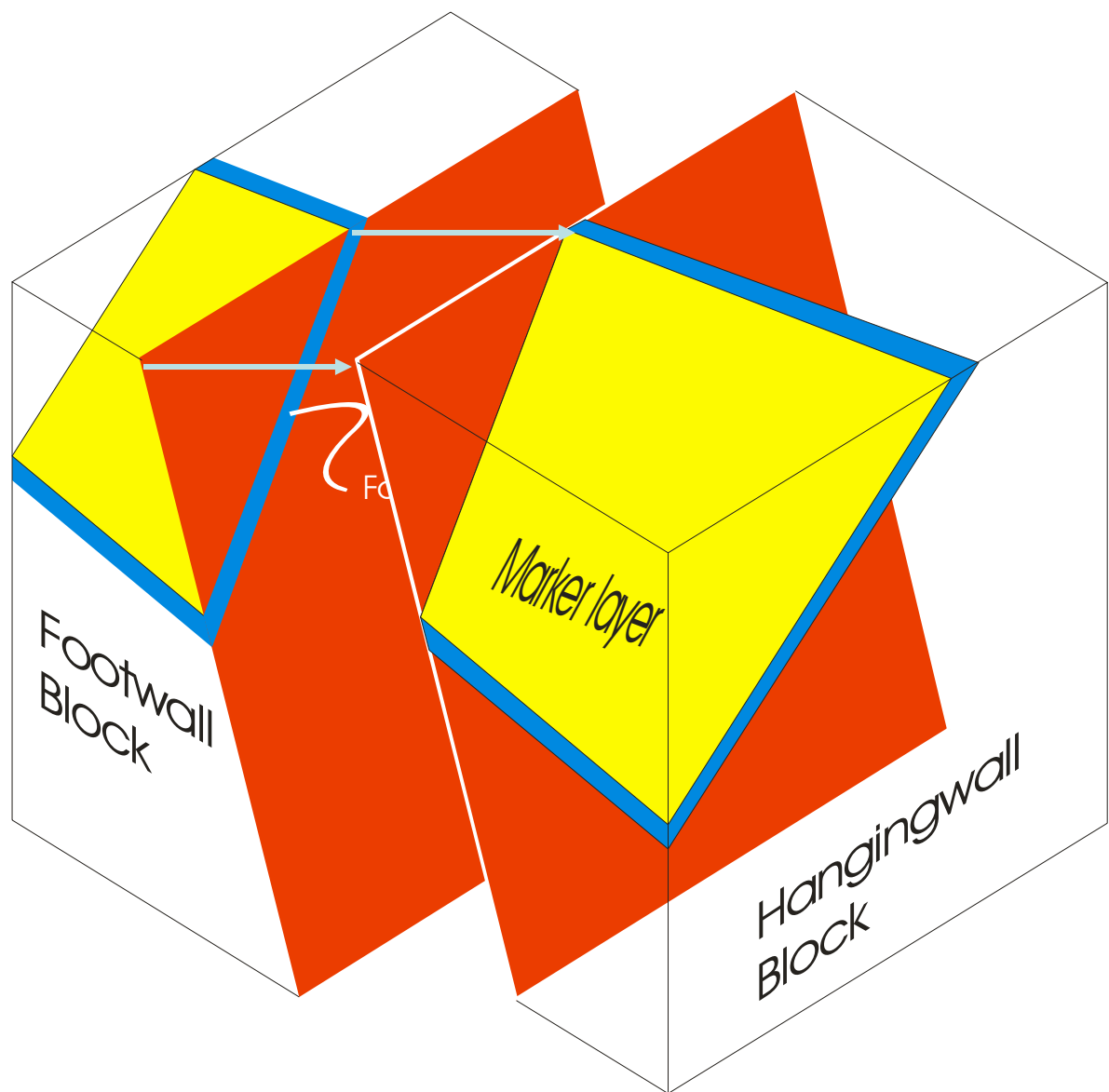
Reverse Fault



Strike-slip Fault



Oblique-slip Fault



Fault Classification

Dip-slip faults

- **Normal (detachment) faults**
- **Reverse (thrust) faults**

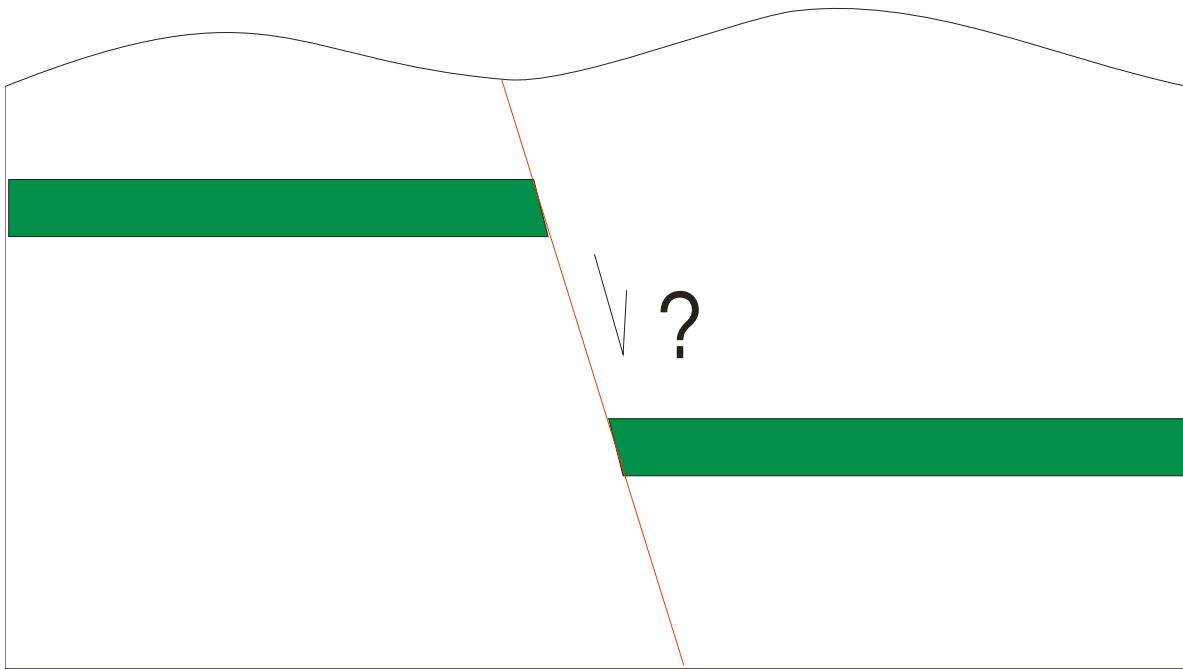
Strike-slip faults

- **sinistral (left-lateral)**
- **dextral (right-lateral)**

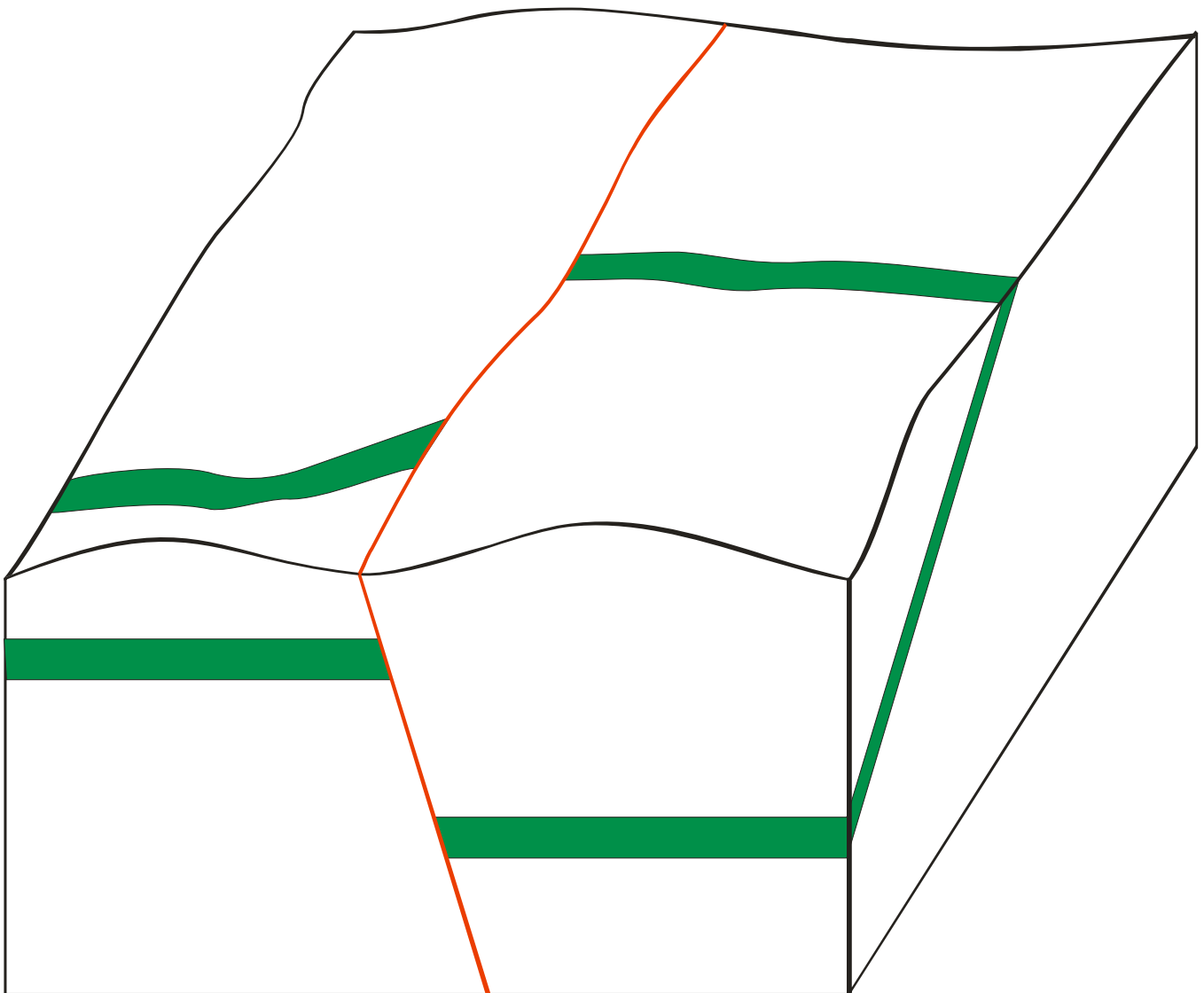
Oblique-slip faults

e.g. dextral normal fault

Is this a normal fault?
What else could it be?

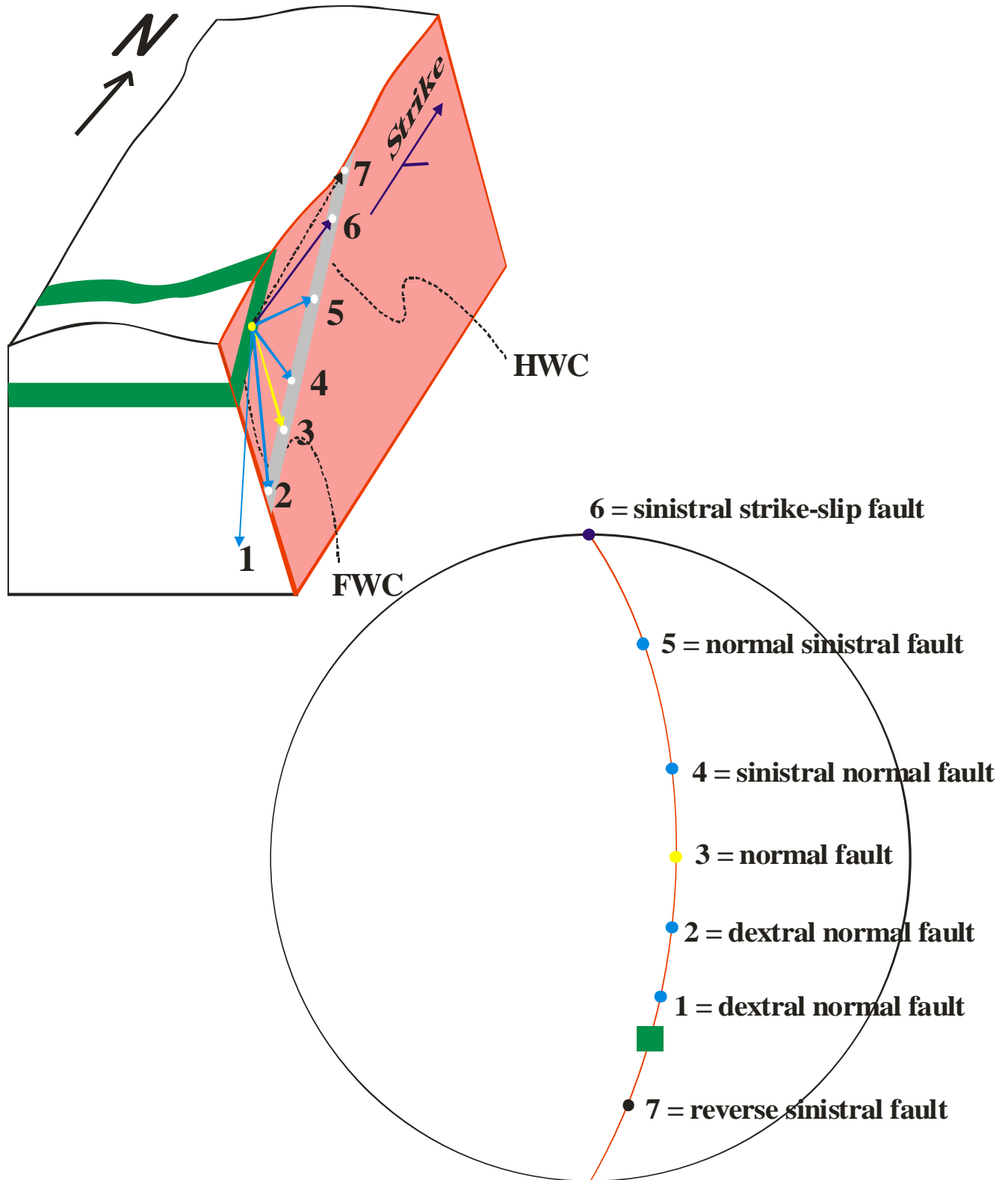


A possible 3D geometry
What is this fault?



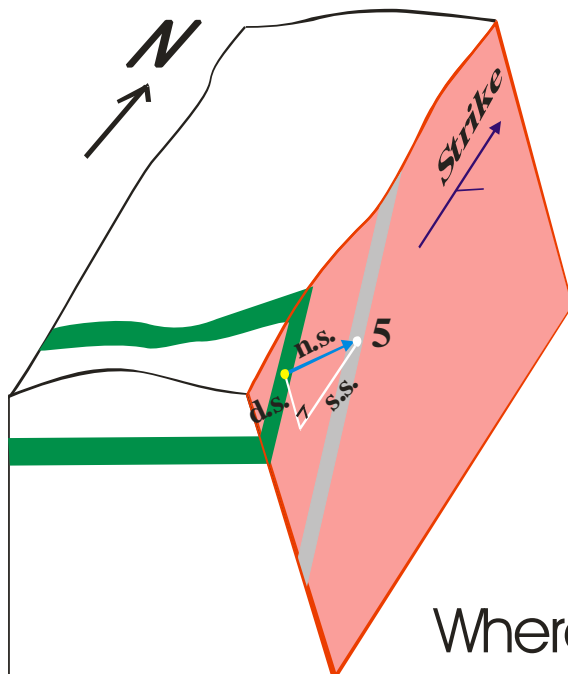
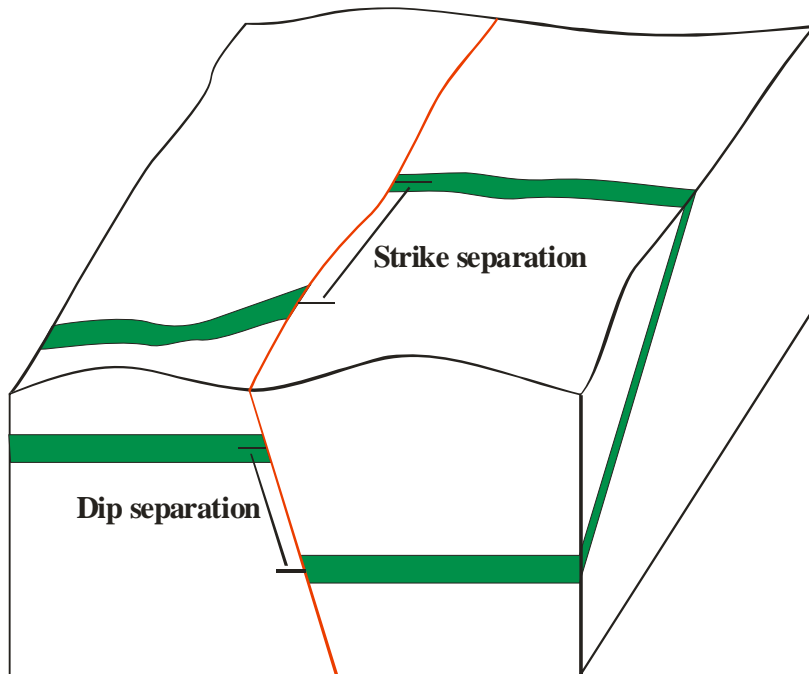
Hanging-wall removed view

Possible net-slip directions!!

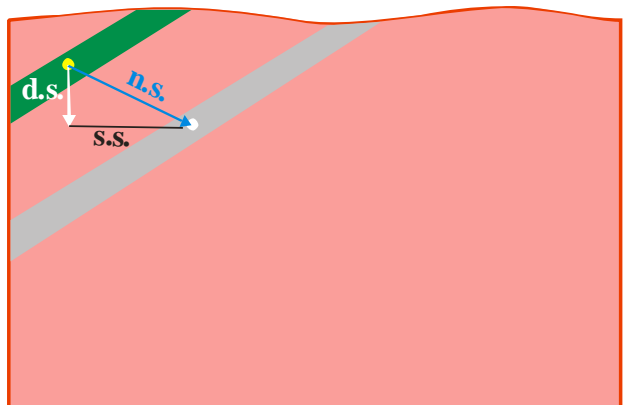


Slip vs Separation

They are distinct!

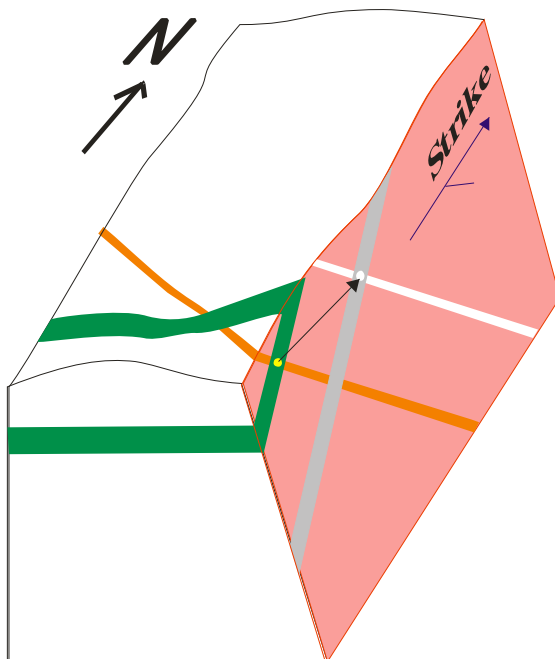
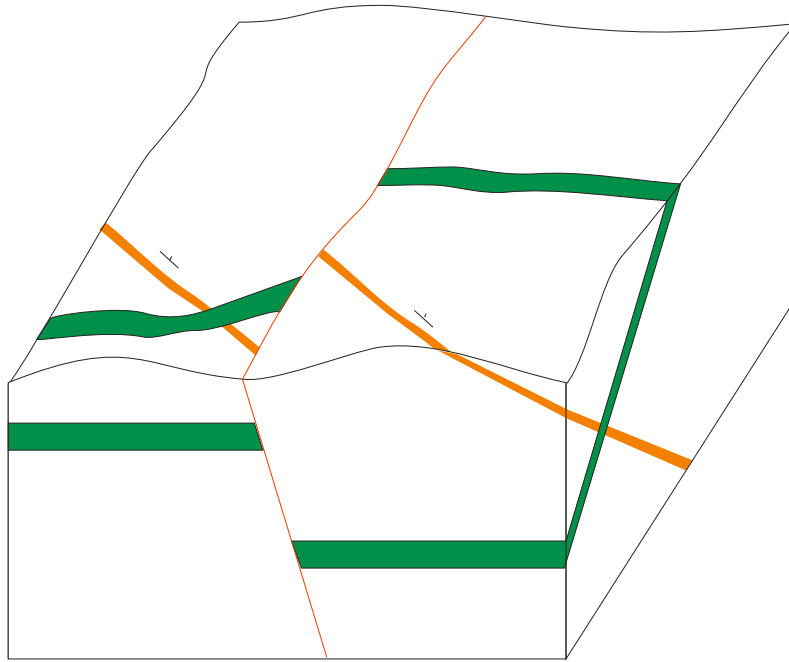


Fault-plane view

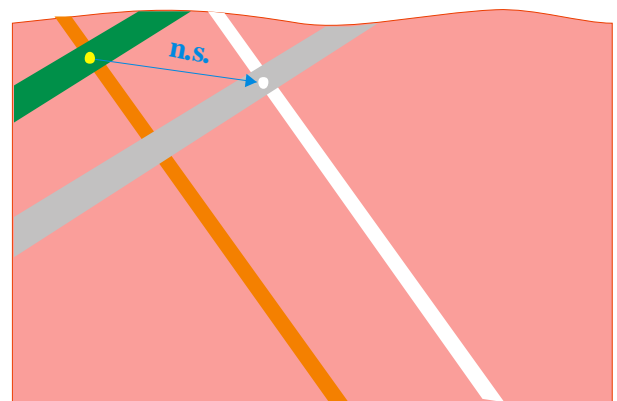


Where to draw the separations?

Piercing point method to determine net slip



Fault-plane view



Fault-related Rocks

Fault Identification

Fault Zone Structure

Faults and ductile shear zones

Upper Crust: temperature low and fluid common: brittle deformation

Mid and Lower Crust: high temperature and confining pressure: ductile deformation

Brittle-Ductile Transition

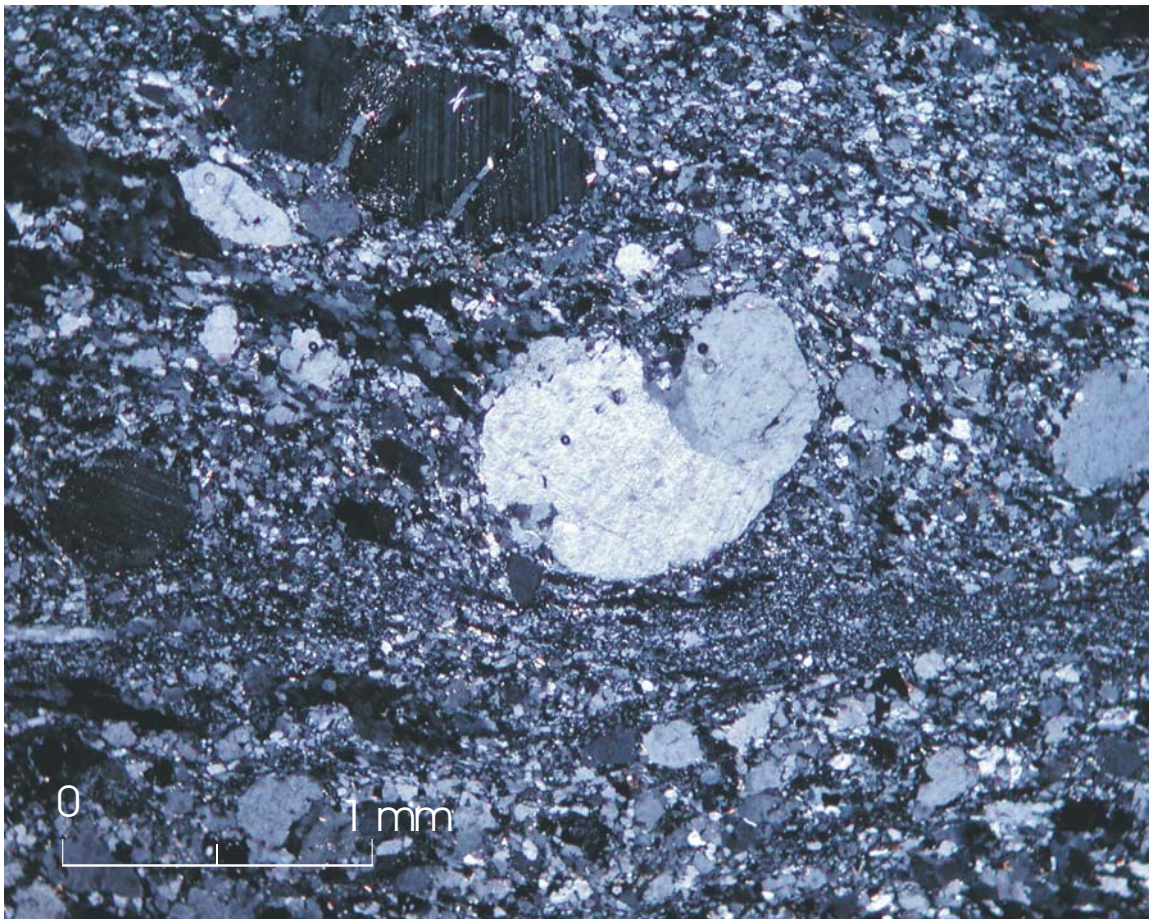
Products of brittle deformation

-- Fractures and Cataclastic fault rocks:

Gouge: very fine-grained clayey fault rock. Grain size in general is $< 0.1\text{mm}$. Grainsize reduction is due to fracturing and grinding.

Breccia: fault rocks composed of angular fragments (clasts) of wall rocks and a matrix of finer-grained wall rocks.

Cataclasite: Fine-grained fault rock with up to 50% visible but fine-grained clasts.



Pseudotachylite: Frictional
melt in dry conditions due to
high strain rate deformation
(earthquake)



Products of ductile deformation

-- Ductile shear zones and mylonite series of fault rocks:

Mylonite: Fault rocks composed of a ground mass with or without porphyroclasts. The grainsize reduction is NOT due to fracturing or grinding, but due to dynamic recrystallization.

Depending on the completeness of recrystallization, we have protomylonite, mylonite, and ultramylonite.



Mylonite hand sample, mylonite derived from granite