Fold (geology)

In structural geology, a **fold** is a stack of originally planar surfaces, such as sedimentary strata, that are bent or curved during permanent deformation. Folds in rocks vary in size from microscopic crinkles to mountain-sized folds. They occur as single isolated folds or in periodic sets (known as *fold trains*).

Synsedimentary folds are those formed during sedimentary deposition.

Folds of alternate layers of limestone and chert occur in Greece. The limestone and chert were originally deposited as flat layers on the floor of a deep sea basin. These folds were created by Alpine deformation.

Folds form under varied conditions of stress, pore pressure, and temperature

gradient, as evidenced by their presence in soft sediments, the full spectrum of metamorphic rocks, and even as primary flow structures in some igneous rocks. A set of folds distributed on a regional scale constitutes a fold belt, a common feature of orogenic zones. Folds are commonly formed by shortening of existing layers, but may also be formed as a result of displacement on a non-planar fault (*fault bend fold*), at the tip of a propagating fault (*fault propagation fold*), by differential compaction or due to the effects of a high-

Types of fold

An anticline in New Jersey

A monocline at Colorado National Monument

- Synform: linear, strata dip toward the axial center, age unknown, or inverted.
- Dome: nonlinear, strata dip away from center in all directions, *oldest* strata in center.
- Basin: nonlinear, strata dip toward center in all directions, *youngest* strata in center.
- Monocline: linear, strata dip in one direction between horizontal layers on each side.
- Chevron: angular fold with straight limbs and small hinges

- Recumbent: linear, fold axial plane oriented at a low angle resulting in overturned strata in one limb of the fold.
- Slump: typically monoclinal, the result of differential compaction or dissolution during sedimentation and lithification.
- Ptygmatic: Folds are chaotic, random and disconnected. Typical of sedimentary slump folding, migmatites and decollement detachment zones.
- Parasitic: short-wavelength folds formed within a larger wavelength fold structure - normally associated with differences in bed thickness[8]

- Disharmonic: Folds in adjacent layers with different wavelengths and shapes[8]

(A homocline involves strata dipping in the same direction, though not necessarily any folding.)

Causes of folding

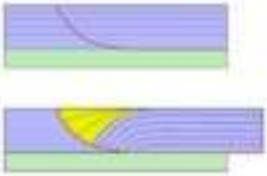
Folds appear on all scales, in all rock types, at all levels in the crust. They arise from a variety of causes.

Layer-parallel shortening

Box fold in La Herradura Formation, Morro Solar, Peru

When a sequence of layered rocks is shortened parallel to its layering, this deformation may be accommodated in a number of ways, homogeneous shortening, reverse faulting or folding. The response depends on the thickness of the mechanical layering and the contrast in properties between the layers. If the

layering does begin to fold, the fold style is also dependent on these properties. Isolated thick competent layers in a less competent matrix control the folding and typically generate classic rounded buckle folds accommodated by deformation in the matrix. In the case of regular alternations of layers of contrasting properties, such as sandstone-shale sequences, kink-bands, box-folds and chevron folds are normally produced.[9]



Many folds are directly related to faults, associated with their propagation, displacement and the accommodation of strains between neighboring faults.

Fault bend folding

Fault-bend folds are caused by displacement along a non-planar fault. In non-vertical faults, the hanging-wall deforms to accommodate the mismatch across the fault as displacement progresses. Fault bend folds occur in both extensional and thrust faulting. In extension, listric faults form rollover

Detachment folding

When a thrust fault continues to displace above a planar detachment without further fault propagation, detachment folds may form, typically of box-fold style. These generally occur above a good detachment such as in the Jura Mountains, where the detachment occurs on middle Triassic evaporites.[13]