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Genesis of Normal Compound, and Normal Horizontal Faulting

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the presence of broad terraces at various elevations and other topographic forms indicate plainly the region has been one of recent oscillation and that the terraces mark stages in the cycles when for a considerable period little movement took place.

GENESIS OF NORMAL COMPOUND, AND NORMAL HORIZONTAL FAULTING.

BY CHARLES R. KEYES.

(Abstract.)

In the mining districts of mountainous regions the ore-bearing belts are quite often coincident with fault planes. These planes are not usually clean-cut, single slipping surfaces, but consist of a number of gliding faces distinct from one another, sometimes branching, sometimes crossing at low angles, and contain in their immediate neighborhood more or less brecciated material. This compound character of what we are prone to pass over as single, simple dislocation, is found, after a little careful examination, to prevail in the majority of cases.

As the slipping commonly occurs in districts in which folding of strata has been more or less intense, it is not frequently taken for granted that the dislocation is of the nature of reverse faulting. This conclusion is apt to be reached when the detailed proofs are obscure, or not clearly made out.

In many cases, in regions in which the strata have been folded, normal faulting is known to be of frequent occurrence. The illustrations are numerous. The beautiful examples depicted by Spurr in his recent work on the Aspen mining district of Colorado are especially noteworthy as typical developments of the normal compound, or normal horizontal faults. Although not clearly shown in his diagrams, in other localities it is known that the origin of the phenomena is due to a comparatively sudden relaxation of the pressure, allowing the crest of a fold to settle somewhat. When the strata are gradually bowed upward, they do not fracture but flow, as it were, into position; but when the compressing forces are relieved suddenly the layers cannot respond in the same way. They are broken.

In the case of a strongly curved fold the pressure may be relieved locally by sliding along the bedding plains. In others the fault plane, instead of being almost vertical, may be nearly horizontal, which, in the near proximity to vertical faults, is apparently anomalous.

Both the normal compound and normal horizontal faults are readily reproduced experimentally. Two or three hundred sheets of paper are bent in the form of a pronounced fold, and clamped. The end of the fold is then covered with a colored paste, that becomes somewhat brittle when dry. When the clamps are slowly relieved the sheet of paste on the end indicates at once the movements of the strata of paper, and the directions and locations of the sudden movements and the production of the phenomena corresponding to the dislocations. On this transverse plate of paste the compound normal faulting and normal horizontal faulting is beautifully portrayed in miniature.

A STUDY OF THE CHEMICAL COMPOSITION OF SOME OF THE GRASSES OF THE STATE.

BY J. B. WEEMS.

One of the problems in connection with the work of the experiment station for the past two or three years has been an investigation of the native grasses of the state. The work has been carried on by the botanical and chemical sections of the station and the results which are presented here may be regarded as a part of this work. The analyses presented are of those grasses which have been most thoroughly investigated and are as follows: (1), *Dactylis glomerata* (orchard grass); (2), *Muhlenbergia Mexicana* (Mexican wood-grass); (3), *Spartina cynosuroides* (fresh water cord grass); (4), *Poa pratensis* (Kentucky blue grass).

The first of these to be considered is *Dactylis glomerata* or orchard grass. In the eastern states and the older settled countries this grass has been known for a long time and is considered one of the most valuable pasture grasses. The good properties of the grass consist in being an early and rapid grower and with strong resisting powers against drouth. If allowed to grow to extreme height it is said to become coarse