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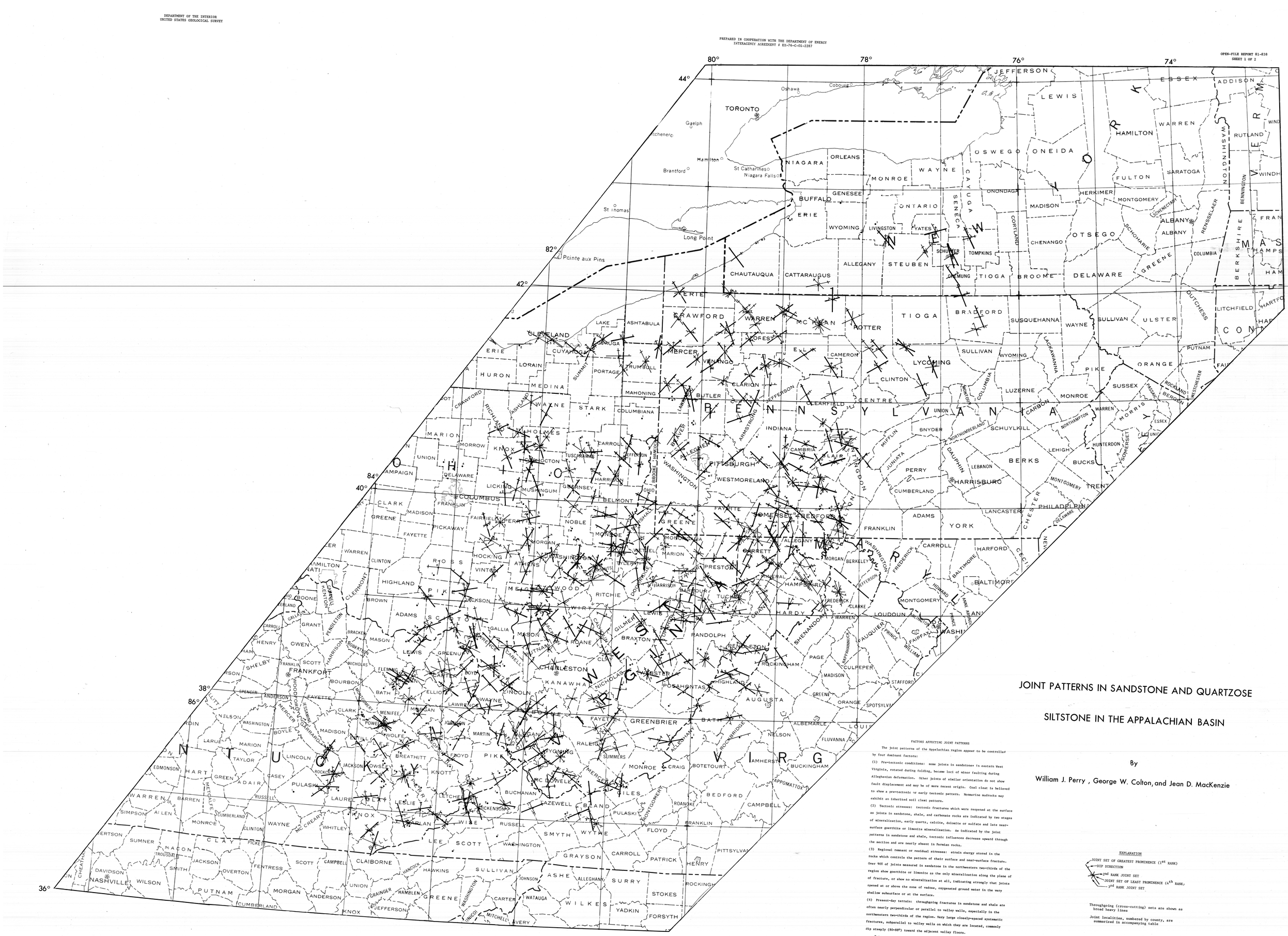
SHEET 1 OF 2



JOINT PATTERNS IN SANDSTONE AND QUARTZOSE SILTSTONE IN THE APPALACHIAN BASIN

By

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FACTORS AFFECTING JOINT PATTERNS

The joint patterns of the Appalachian region appear to be controlled by four dominant factors:

(1) Pre-tectonic conditions: some joints in sandstones in eastern West Virginia, rotated during folding, became loci of minor faulting during Alleghenian deformation. Other joints of similar orientation do not show fault displacement and may be of more recent origin. Coal cleat is believed to show a pre-tectonic or early tectonic pattern. Nonmarine mudrocks may exhibit an inherited soil cleat pattern.

(2) Tectonic stresses: tectonic fractures which were reopened at the surface as joints in sandstone, shale, and carbonate rocks are indicated by two stages of mineralization, early quartz, calcite, dolomite or sulfate and late near-surface goerthite or limonite mineralization. As indicated by the joint patterns in sandstone and shale, tectonic influences decrease upward through the section and are nearly absent in Permian rocks.

(3) Regional remnant or residual stresses: strain energy stored in the rocks which controls the pattern of their surface and near-surface fracture. Over 90% of joints measured in sandstone in the northwestern two-thirds of the region show goerthite or limonite as the only mineralization along the plane of of fracture, or show no mineralization at all, indicating strongly that joints opened at or above the zone of vadose, oxygenated ground water in the very shallow subsurface or at the surface.

(4) Present-day terrain: throughgoing fractures in sandstone and shale are often nearly perpendicular or parallel to valley walls, especially in the northwestern two-thirds of the region. Very large closely-spaced systematic fractures, subparallel to valley walls on which they are located, commonly dip steeply (80-88°) toward the adjacent valley floors.

Data to test the importance of each of these factors (oxygen isotopic ratios or fluid inclusions in mineralized fracture fillings or in situ strain measurements) were beyond the scope of the Devonian Shale Structure Project.

EXPLANATION

JOINT SET OF GREATEST PROMINENCE (1st RANK)
DIP DIRECTION
2nd RANK JOINT SET
JOINT SET OF LEAST PROMINENCE (4th RANK)
3rd RANK JOINT SET

Throughgoing (cross-cutting) sets are shown as broad heavy lines

Joint localities, numbered by county, are summarized in accompanying table

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature.

SCALE 1:1 000 000

25 0 25 50 75 100 125 150 175 KILOMETERS
25 0 25 50 75 MILES