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FRIENDS OF PLEISTOCENE GEOLOGY

ANNUAL REUNION MAY 24 - 25, 1958, HARRISONBURG, VA.

Registration: - Owing to several problems, including the necessity for bus transportation as explained below, we have decided to charge a registration fee of $4.00 payable on or before May 24 to J. T. Hack. This fee will include bus transportation from stop 2A to stop 2, the cocktail party, and dinner on Saturday evening. The fee does not include luncheon on either day.

How to get there: - Harrisonburg is at the junction of U. S. 11, a main north-south highway, and U. S. Route 33. If you are coming from New York or Philadelphia it is best approached via Washington, D. C. and from there Route 211 to New Market, and Route 11 to Harrisonburg. If you come by train or plane, you can get directly to the Belle Meade Motel, the headquarters, from Washington, D. C. or Winchester, Virginia, by Greyhound Bus. Transportation can probably be arranged from Washington if you will contact J. T. Hack in advance.

Headquarters: - The headquarters will be at the Belle Meade Motel on U. S. Route 11, 1½ miles south of Harrisonburg, Virginia. This is a Quality Court having 120 rooms. It is completely air-conditioned and has a large restaurant and private dining room. Accommodations are $6.00 - 6.50 for singles, $9.50 - 10.00 for twin-bedded rooms, and $8.50 for double bed for two. You are urged to make reservations in advance as travel is heavy at this time of year.

Other accommodations: - Other good accommodations can be had at Pure Village Motel, and Valley Lee Motor Court (less expensive), both about 2 miles south of the Belle Meade on U. S. Route 11. There are many other good places nearby including the Hotel Kavanaugh in Harrisonburg (On U. S. Route 11, North).

Program for first day (PLEASE NOTE CAREFULLY): - We will meet in the parking area at the Belle Meade Motel Saturday morning at 8:00 o'clock. BE SURE TO BRING YOUR LUNCH. The first day will be spent in and around the Little River Valley about 25 miles west of Harrisonburg in the Shenandoah Mountains. The road from stop 2A to stop 2 (2 miles) is a logging road completely impassable for ordinary passenger cars and is not negotiable on foot (dry, that is) because of several stream crossings that in a wet spring may be almost knee deep. Accordingly we have engaged a high-chassis bus that we hope will be able to make the two miles. If there are more than 30 in the group the bus will make 2 trips. On the first day the bus will be available all day and can transport about 30 of us. The remainder will travel by passenger car as far as stop 2A leaving their cars at a parking area at this point. Note that Jeep station wagons, pick-up trucks, and carry-alls can make the trip up to stop 2 handily unless the river should be in flood, in which case we'll all do something else.

Annual Dinner: - The dinner on Saturday night will be held at the Belle Meade Restaurant in a private dining room. Cocktails will be served in the private dining room at 6:30 P. M., dinner following.

Second day: - On the second day we will meet at 8:00 A. M. and travel in our passenger cars. We will not return to Harrisonburg and the trip will end about noon near the town of Luray at the junction of routes 340 and 211, both main roads north.

Technical Information

Subjects to be discussed: - We are attempting to present two subjects of very different nature. On the first day we will discuss erosion and deposition in mountain valleys, by cloudburst floods, and the relation of forest vegetation to topographic form, erosion processes and the soil mantle. The area visited is the Little River area, the location of joint studies in which botany played a major role by John C. Goodlett and John T. Hack in 1955 and 1956. On the second day we will discuss the origin of features on the floor of the Shenandoah Valley with particular reference to the Harrisburg peneplain - or lack of one. This problem has been an important objective of Hack's study since 1952 and the area visited is part of a reconnaissance survey covering the entire Shenandoah Valley made during 1956 and 1957.

Maps that may be useful on the trip: - The entire field trip area is shown on the Charlottesville Sheet of the 1:250,000 topographic series of the United States, distributed by the U. S. Geological Survey. All stops of the first day are shown on the Parnassus, Va. 15 minute quadrangle of the U. S. Geological Survey. You are urged to bring this quadrangle. The stops of the 2nd day are shown on the Harrisonburg, Elkton, and Mt. Jackson 15 minute quadrangles.

Publications that deal with pertinent problems: -

1. Butts, Charles, Geology of the Appalachian Valley in Virginia: Virginia Geological Survey Bull. 52, 1940 (although there are many good later studies that have made considerable revision, this bulletin is still a standard reference on the bedrock geology).

2. Butts, Charles, Geologic Map of the Appalachian Valley in Virginia: Virginia Geological Survey, 1933. (If you have this map by all means bring it along).

3. Edmundson, R. S., Origin of Little North Mountain in Virginia: Journal of Geology, vol. 48, p. 532-551, 1940 (a discussion of the topographic form of mountain ridges and the question of the accordance of summits).

4. Thompson, H. D., Topographical analysis of the Monterey, Staunton, and Harrisonburg quadrangles, Va.: Jour. Geol., vol. 49, p. 521-549, 1941.

5. King, P. B., Geology of the Elkton area, Va.: U. S. Geological Survey Prof. Paper 230, 1950 (A very good publication to have along on the trip. Stop 9 is in this area).

6. King, P. B., 1949, The Floor of the Shenandoah Valley: Amer. Jour. of Science, vol. 247, p. 73-93, 1949 (An excellent paper describing the floor of the valley, but presenting an interpretation quite different from the one to be discussed on this trip).

7. Hack, J. T., 1957, Studies of longitudinal stream profiles in Virginia and Maryland: U. S. Geological Survey Prof. Paper 294-B. (The conclusions presented in this paper are preliminary to the interpretation of the Shenandoah Valley floor to be presented at this meeting).

Brief description of proposed stops: - 1. View of flood plain of the North River near Mt. Solon. The North River is a stream originating in the mountains that carries a heavy load of sandstone cobbles. It migrates laterally forming a broad floodplain and over a long period of geologic time has produced a rock-floored, pediment-like fan. Its tributary, Mossy Creek, flows entirely in limestone and as a consequence has eroded its valley more rapidly and at Mt. Solon has reached a lower elevation than the North River. The piracy of the North River by Mossy Creek is imminent. During the great flood of 1949, water actually spilled across the divide.

2A. Parking area in Little River Valley. At this place forest vegetation typical of the floodplain can be seen and compared with the forest typical of drier mountain slopes. The mechanism by which the floodplain forms can be inferred. Vegetation and stream deposits characteristic of the present channel, the 1949 flood channel, and the older floodplain (undamaged in 1949) will be examined.

2. North Fork of the Little River, a valley severely damaged by the 1949 flood. Several hours will be spent here to view flood effects and such features as flood-produced terraces, alluvial fans, debris avalanches and other features.

3. A mountain hollow near the summit of Shenandoah Mountain on the road from Briery Branch to Sugar Grove, West Va. This hollow was mapped and studied in detail by Goodlett and Hack in 1955. The relation of vegetation to the form of slopes can be readily seen. If time is available the group may explore the floor of the hollow. A side trip may be made to the summit of Reddish Knob to see the view.

4. A short stop to examine an exposure of alluvial gravel on limestone residuum. Will be omitted if time is short.

5. Exposure of cherty residuum characteristic of the Beekmantown dolomite.

6. Area of thin soil with many rock outcrops characteristic of the belt of outcrop of the Athens limestone, a chert-free limestone.

7. Exposure typical of the Martinsburg shale in the center of the valley. Note thin soil, lack of residuum.

8. Exposure and topography characteristic of Beekmantown dolomite on limb of syncline opposite from stop 5.

9. Fox Mountain mine. Old workings of iron mine showing excellent exposures of residuum (saprolite) on Waynesboro formation. This is under old high-level gravel deposit, now partially removed by erosion (King's No. 1 terrace which may be seen at top of hill).

10. Residuum or saprolite developed on Martinsburg shale under cover of alluvial gravel. Compare this exposure with that at stop 7, where there is no alluvial gravel and no saprolite.

Geomorphology and Forest Ecology of a Mountain Region in the Central Appalachians

(Abstract of unpublished manuscript by John T. Hack and John C. Goodlett)

The area studied in northern Virginia includes about 55 square miles of densely forested mountain land and has an average relief of about 1,500 feet. It is part of an area subjected to a violent cloudburst in June of 1949 that damaged large tracts on slopes and bottomlands. Most of the area is underlain by flaggy arkosic sandstone and interbedded reddish shale of the Hampshire formation of Devonian age. The highest ridges are capped by massive sandstones of the Pocono formation of Mississippian age. In most of the area the rocks dip gently to the southeast but in the northwestern and southeastern parts they are folded into synclines that localize northeast-trending ridges.

Topography is remarkably uniform and the slopes are graded to regular forms that may be described in simple mathematical terms. Because of a high bifurcation ratio between streams of different orders, almost half of the area is composed of first-order valleys. Each of the first-order valleys may be subdivided into five different parts, based on the convexity or concavity of the contours. Each of the parts, because of its geometric form, receives water downslope at different rates. The driest area, on which the contours are convex outward (from the mountain), is called the "nose" and presumably receives the least moisture by flow from the slope above. The side slope has straight contours and hypothetically receives somewhat greater runoff. The hollow above the stream head is an area of concentration of the drainage lines in which the discharge of storm runoff is inferred to increase downslope at a rate greater than the square of the distance. It merges with the channelway, a narrow strip running down the valley axis between steep side slopes. In the channelway, runoff increases downstream in proportion to the 1.6 power of the length. The channelway at some places is bordered by a narrow strip of concave-upward slope that because of its geometric form receives somewhat more runoff than the side slopes above. In valleys larger than the first and second order the channelway is so broad that the stream channel itself is bordered by bottomlands many times larger. All of the bottomlands are subject to erosion or deposition during floods of various frequencies.

The stony and bouldery soils of the mountain slopes were sampled at many localities by measuring the diameters of individual particles selected at points on a grid pattern. The mean size of the particles on the surface of the ground are found to vary markedly from part of the one valley to another and to increase roughly with the runoff concentration inferred from the topography. The texture of debris is fine on noses and coarse in channelways and hollows. Mean size ranges from less than 1 millimeter on some noses to over 250 millimeters in some hollows. In the channelway the size generally decreases to a figure near 100 millimeters and remains about constant in a downstream direction. Standard deviation or sorting of the particles narrows as drainage area increases.

Fields of large, angular quartzite blocks are conspicuous features of some side slopes and noses. They generally occur where massive quartzitic sandstone of the Pocono formation crops out in an exposed location such as a ridge top or nose, and where the sandstone is underlain by relatively soft shale. In these places boulders have slid down, forming a mantle on the slope below.

The vegetation of the area includes about 45 species of trees, 25 of which are closely related in their local distribution to moisture conditions. Concentration of runoff related to topographic forms is a particularly important factor. The close relation between the vegetation, the landforms, and the texture of the soil mantle is shown by the analysis of sample plots in seven first-order valleys, on several ridges, and on the flood plain of the Little River. Vegetation was further studied by the preparation of a forest map on which the vegetation is classed in three units based on the presence or absence of a few samples. Map unit 1, the northern hardwood forest, defined by the presence of yellow birch, basswood, and sugar maple, or any one of the three, occupies moist environments such as hollows and bottomlands. Map unit 2, the yellow pine forest defined by the presence of pitch pine and table-mountain pine, or either one of the two, and by the absence of the species that define unit 1, occupies relatively dry sites such as ridges and noses. Map unit 3, the oak forest, defined by the absence of all of the above species, occupies intermediate sites, especially side slopes. Each of the three forest types contains many other characteristic species, especially oaks that are also affected by topographic position.

The ground cover of shrubs and herbaceous plants varies in composition in a manner similar to that of the trees. The form of the forest also changes in relation to topography and moisture, for the trees grow larger and taller in the hollows than on noses and side slopes. The distribution of the map units is thought to coincide with the duration of moisture in the ground through the growing season. Environmental factors that affect moisture directly also affect the physiological processes of the plants. The relation is both direct and indirect, and no cause and effect relation between moisture regimen and species distribution is implied. Topographic position on the slope is an important factor determining the moisture regimen, but so also are geologic structure, soil texture, exposure, and altitude.

The violent cloudburst flood of June 1949 that caused severe erosion in Little River valley afforded an opportunity to study the importance of extremely low frequency floods as agents of erosion and as factors in forest ecology. During this storm, that probably lasted only a few hours, rainfall in excess of 9 inches fell on an area centered over Buck Mountain. The runoff produced dozens of debris avalanches on the upper mountain slopes, enlarged most of the channelways, and reworked the debris on the bottomlands of many larger valleys and in places removed the forest cover on the entire valley floor. The high rates of runoff were effective in eroding mountain slopes, sorting surficial debris, transporting debris, and producing terraces, alluvial fans, and cones. It is believed that such floods, though rare, occur frequently enough to exceed in importance as erosive agents all intervening lesser floods that do not damage the forest. The floods are also an important element in the life history of the forest, providing open spaces for the growth of trees that require open sky, thus keeping the species composition in a state of flux.

A special study was made of asymmetric topographic forms in the area. Mountain slopes on the average are steeper facing the northeast and southeast quadrants. Asymmetry of the slopes is accompanied by differences in soil texture and vegetation. The differences are believed due to moisture conditions as determined by geologic structure and by exposure. In drainage areas of similar size the steeper slopes correlate with finer textured soils and more open forest floor characteristic of the northern hardwood type.

Inasmuch as the present topography and distribution of the vegetation can be understood in terms of observable processes active today or in the recent past, neither peneplanation nor progressive biological succession need be called upon in order to explain their characteristics. The regularity of the forms and their close relation to the geology and vegetation, on the contrary, argue in favor of more uniformitarian concepts.

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Geomorphic significance of residual and alluvial deposits in the Shenandoah Valley, Virginia

(Abstract of paper presented by J. T. Hack at Virginia Academy of Sciences, May 9, 1958)

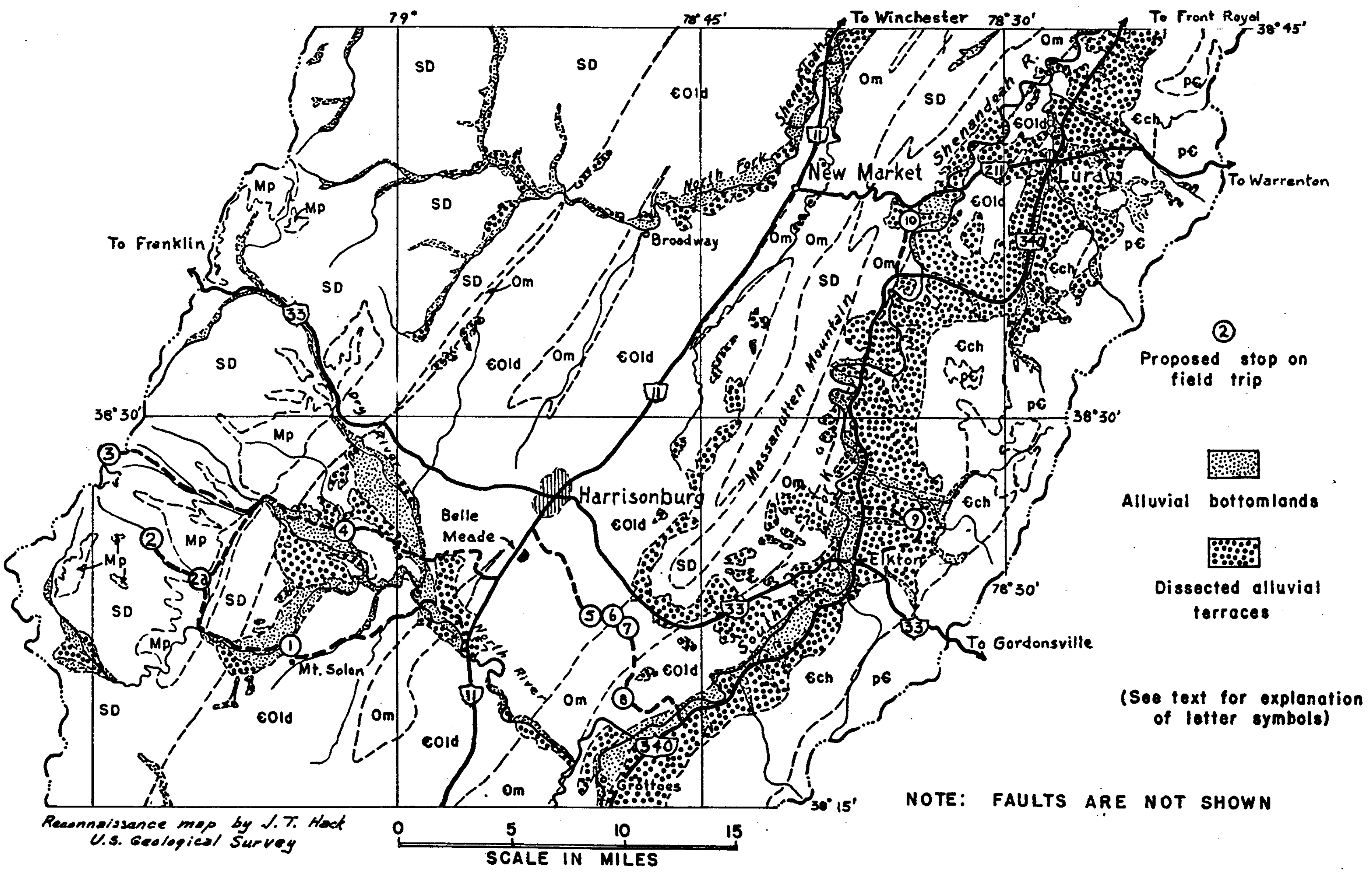
Study and mapping of the surficial deposits in the drainage basin of the Shenandoah River indicate a close relation between Bedrock and the distribution of residual and alluvial deposits. Saprolite is widely distributed on the Cambrian and Ordovician limestones, especially on rocks like the upper part of the Beekmantown dolomite that contain massive chert. The chert forms a residual mantle of stones that protects the finer grained insoluble residue from erosion. Saprolite is commonly absent on rocks like the Martinsburg and Athens formations that, on weathering, do not yield coarse insoluble fragments.

Alluvial deposits cover less than one-third of the valley floor, and occur where streams enter limestone or shale areas from mountains underlain by more resistant sandstone and quartzite. Coarse alluvium is deposited near the mountain foot by laterally migrating streams in pediment-like aprons. Piracies occur in these areas because the main streams issuing from the mountains have steeper gradients than their own minor tributaries that head on the valley floor, in softer rocks.

The rough accordance of summit levels of the hills on the valley floor that has given rise to the concept of a valley floor peneplain results from the adjustment of slopes to a regularly spaced drainage network in a region having rocks that are roughly of the same resistance. Relief is considerably lower in the Martinsburg shale areas, however, than in limestone areas and is highest in the outcrop belt of the Beekmantown dolomite. The present topography is better explained as the result of long-continued and deep erosion of a folded mountain chain that is close to isostatic equilibrium than by a theory involving still stand, uplift, and erosion, such as the theory of multiple erosion cycles.

Explanation of map symbols

p€	-	Pre-Cambrian igneous rocks and meta sediments. Includes hypersthene granodiorite and Catoctin greenstone. Underlies east slope and crest of Blue Ridge Mts., on the eastside of the valley.
€ch	-	Chilhowee group of Lower Cambrian age. Includes siltstone, sandstone and massive quartzite that forms foothills along the west slope of the Blue Ridge. The Antietam quartzite (uppermost Chilhowee) forms extensive talus and scree deposits and supplies abundant quartzite cobbles for the terraces and fans on the Shenandoah Valley floor.
€Old	-	Cambrian and Ordovician limestone and dolomite. Includes the following formations (after Charles Butts, 1952): Tomstown, Waynesboro, Elkbrook, Conococheague, Chepultepec, Beekmantown, Lenoir, Mosheim, Athens, and Chambersburg. These carbonate rocks underlie the largest part of the floor of the Shenandoah Valley. The residuum or saprolite formed on some of them will be examined on the second day of the field trip.
Om	-	Martinsburg shale of Ordovician age. An isoclinally folded shale and siltstone with a prominent fracture cleavage. Underlies a broad belt in the Massanutten syncline. This is the weakest rock in the area. The classic meanders of the Shenandoah River and of the Middle River are developed in this formation and are believed to be related to the strongly developed structures in the rock.
SD	-	Silurian and Devonian rocks. These rocks are mostly clastics, but include some thin limestone beds. The principal formations of geomorphic interest are the Massanutten sandstone and its equivalent, the Tuscarora (ridge makers), the Clinton formation, Brallier and Romney shales (weak-rock lowland formations), the Chemung and Hampshire formations (interbedded sandstones and shales that generally underlie mountains).
Mp	-	Pocono formation of Mississipian age. Sandstone, shale, and quartzite. The strongest ridge-maker west of the Shenandoah Valley.



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