A more detailed presentation of this work will appear in the near future.

1 From the Rockefeller Institute for Medical Research, Department of Animal and Plant Pathology, Princeton, N. J.; and the Department of Biology, School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Md.


6 Demerec, M., "Behavior of Two Mutable Genes of *Delphinium ajacis,*" *J. Genetics*, 24, 179–193 (1931).


8 Patterson, J. T., "A New Type of Mottled-Eyed *Drosophila* Due to an Unstable Translocation," *Genetics*, 17, 38–59 (1932).

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THE HIGHER CRYSTALLINE PLATEAU OF SOUTHEASTERN BRAZIL

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There has been considerable discussion concerning the relationship between the German concept of the "primärrumpf," and the American concept of the peneplain. The word "primärrumpf" cannot easily be translated. It was introduced by Walther Penck to describe a surface of relatively slight relief which is maintaining or actually decreasing its relief in spite of continuous uplift. Penck's thesis challenges the interpretation of all high-level uniform surfaces as having resulted from baseleveling followed by uplift. He maintains that under certain conditions of accelerated uplift the headwater areas of a drainage system will not feel the effects of rejuvenation. While the larger, lower courses of a stream may be able to overcome the rise of the land and maintain or quickly re-establish a graded condition, the upper parts of the stream system will not be able to do this. According to Penck a convex nick will be formed in the stream profile, bearing no relation to rock structure, and for a time the upper portion of the stream will be graded with reference to the top of this nick rather than to any general regional baselevel. In this way a high altitude surface is supposed to develop with actually decreasing local relief in spite of a constantly increasing altitude.

Such a high altitude surface of apparently decreasing relief exists in
the highlands of southeastern Brazil. Lying chiefly in southwestern Minas Geraes, north of the ranges of low mountains which form a rim to the highlands, and southwest of the Serra do Espinhaço of the central part of this state, is a plateau of crystalline rocks, drained by the Rio Grande, a tributary of the Alto Paraná.² Along the eastern border of this plateau, south of the Serra do Espinhaço, the general elevation of the interfluves is about 1200 meters above sea level. Excepting for this eastern rim, which corresponds quite closely to the divide between the headwaters of the Rio Grande and those of the much shorter streams flowing eastward directly to the Atlantic, most of the plateau lies between 1000 and 1100 meters. It is surmounted, however, by a few isolated conical peaks which rise some 400 meters above the general level.

The landforms of the plateau are strikingly subdued. The interfluves are flattish and broad; the valley sides graded and convex; the valley bottoms broad and swampy; the stream channels shallow and meandering. The very deep decomposition characteristic of the rainy tropics makes the surface exposure of solid bedrock very rare. On this mantle of unconsolidated material, soil creep is very active, and the feeble, overloaded headwater streams, not finding solid footing on bedrock even in their channel bottoms, are forced to wind ineffectually about in flat, marshy aggraded valleys. This would seem to fit quite well the description given by Penck of a "primárrumpf" which, in spite of its altitude, is at the moment decreasing in local relief.

The major features of the surface configuration of this part of Brazil result from quite recent faulting, and from the differential erosion of varied rock types. Under the tropical rainy conditions granites and gneisses decompose rapidly to great depths; but quartzites and schists remain much less affected by weathering. The great difference in resistance of these two groups of rocks is revealed by the sharp rise of the Serra do Espinhaço, composed of quartzites and schists, above the plateau we have just described, which is composed mostly of granites and gneisses. The isolated conical peaks, also, are composed of the more resistant rocks. As Branner,³ and later Harder and Chamberlin⁴ have pointed out, these resistant formations were infaulted into the granites at an early geologic period and exhumed by differential erosion: their steep sides, therefore, represent fault line scarps, probably obsequent.

In a recently published monograph on the geology of Minas Geraes, von Freyberg interprets the subdued landforms of the plateau as resulting from the accumulation of great masses of weathered material.⁶ Regardless of any previous irregularity of the surface, this mass of regolith by sliding, flowing or creeping lowers and rounds the divides and chokes the valleys. Von Freyberg believes that such a process is a characteristic feature of lands in the rainy tropics.⁶
We may state the problem, then: was this 1000 to 1100 meter plateau
given its uniformity of interfluve level solely by the foundering of deeply
decomposed ridges and the filling and choking of the valleys in the area
of granites and gneisses until, most of the slopes being graded, a uniformity
of summit level was developed where none existed before; or has this
foundering process only slightly modified and helped to maintain a pre-
existing subdued surface produced near sea level by stream action and since
uplifted?

The fact that the 1000 meter level is extended into the areas of quartz-
tite and schist in mature valley bottoms does not furnish conclusive evi-
dence for either of these alternatives. If the whole area were reduced
to a peneplain by stream action, it is to be expected that while the rela-
tively weak and decomposed granites and gneisses were being reduced
to a late stage of peneplanation, the valleys in the much more resistant
quartzites and schists would have developed no further than maturity.
However, if a "primärrumpf" were developed at a high elevation on the
weak granites and gneisses without any previous baseleveling, the streams
descending from the higher areas of the Serra do Espinhaço would find
that the newly established surface of accumulation on the plateau would
act as a local baselevel below which they would be unable to cut.

There is another line of evidence, however, which seems to support
the hypothesis of stream baseleveling. The crystalline plateau in eastern
São Paulo state is covered by a series of stratified formations. Most of
these are sedimentary, from Permian to Cretaceous in age; but included
among them are the sills and flows of diabase so widespread in this part
of South America. All these formations dip gently toward the west.
The diabase, being more resistant than the sedimentaries, forms an east-
facing cuesta; the sedimentary strata immediately in contact with the
crustallines, being relatively weak, have been eroded to form a typical
inner lowland. The crystalline plateau in northeastern São Paulo state
reaches the edge of this inner lowland, which here becomes very narrow,
at an elevation of 1000 meters; but toward the south, to the west of the
ranges of mountains in southern Minas Geraes, warping brings the plateau
level to about 800 meters. At this elevation it reaches the crest of the
abrupt escarpment known as the Serra do Mar which terminates the
plateau toward the sea. The important point is that in the north the
1000 meter level is repeated beyond the inner lowland by the summit
level of the diabase cuesta; and in the south where the crystalline plateau
lies at 800 meters, the top of the cuesta is also at 800 meters. Similar
elevations, moreover, are reported by Maack from studies in the state
of Paraná.7 Such a widespread occurrence of the same levels on rocks
of very different kinds seems to indicate a former effective operation of
a regional baselevel, followed by uplift with warping and faulting.
The question remains, then, why that portion of this widespread peneplain in southwestern Minas Geraes should now, in spite of its elevated position, be decreasing in local relief. Von Freyberg's belief that this is the result of climatic conditions seems to be correct in part, but not the whole story. Those parts of the crystalline plateaus of southeastern Brazil which are drained by the shorter and more direct Atlantic drainage are now increasing in local relief in spite of identical climatic conditions. The position of the 1000 meter plateau at the headwaters of the Paraná system would seem to make possible the accumulation of weathered material—an accumulation which is not taking place in the areas drained by streams which are obedient to the regional baselevel.

Unfortunately for the testing of Penck's theory regarding the development of a nick in the profiles of streams in areas now being continuously uplifted, the nick which does occur in the Rio Alto Paraná and its tributary the Rio Grande is related to the passage of these streams over resistant rock. The lower course of the Paraná is graded with reference to its outlet near Buenos Aires. Along the eastern border of Paraguay, however, the Alto Parana flows through a narrow gorge, and on the northern border of Paraguay plunges over the Guayra Falls, held up by the resistant diabase. Above the Guayra Falls the Alto Paraná flows through a youthful but not very deep gorge, at many places interrupted by rapids. The lower part of the Rio Grande is also on diabase. Its profile is ungraded and quite steep as far upstream as the place where it first encounters the diabase, near the northeast corner of the state of São Paulo. Here we find the nick in its profile. Upstream from the diabase the slope of the profile is much less, the upper Rio Grande being virtually unaffected by rejuvenation. The nick at the edge of the resistant diabase forms a local baselevel quite independent of the regional one. The headwaters are aggraded because of the great quantities of load supplied to them. This area will continue to decrease in local relief until the Guayra Falls have worked headward beyond the diabase.

This interpretation includes a climatic condition favorable for the rapid weathering of the weak granites and gneisses; and a headwater position on a river interrupted in mid-course by a resistant rock formation. It does not seem to demand description in terms of a "primârrumpf," but only as another example of a peneplain modified by the specific conditions of structure, process and stage.


2 See map of surface configuration included as figure 3 in P. E. James, "The Coffee
Lands of Southeastern Brazil," *Geogr. Rev.*, 22, 225-244 (1932). The author has in preparation a paper on the surface configuration of the area covered by this map, of which the higher crystalline plateau is the part discussed in this essay.


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STRUCTURE OF THE "ELLICOTT CITY GRANITE," MARYLAND

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*Introduction.*—The Ellicott City granite is situated four miles west-southwest of the city limits of Baltimore, Maryland. The Patapsco River valley furnishes good exposures across the entire length of the granite body. Investigations were begun as a demonstration in granite-tectonic methods and were carried on in detail, because of the special situation of this peculiar granite mass. The map, figure 1, comprises the granitic area and a part of the surrounding wall rocks and their structure.

*The Problems.*—The geologic map of Maryland and of Baltimore county shows a granite body which seems to be discordant within the Piedmont region, the strike of its long axis being NW-SE whereas the general strike of the region is NE-SW.

It is clearly seen on the map that the granite intruded the gabbro and the Wissahickon schist, where the latter formed a salient that penetrates far into the large gabbro complex.

This peculiar position of the granite raises a few questions:

- The mode of emplacement of the granite.
- The structure of the granite and its relation to the wall rock structure.
- The structural position of the granite within the Piedmont.

Granite and gabbro \{ discordance or \\
Granite and Wissahickon schist \} concordance?

Is the granite the top part of a hidden batholith?