GEOLOGY OF THE LOWER BONITA CREEK AREA

(A Preliminary Report)

By

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INTRODUCTION

The lower Bonita Creek area is in east-central Graham County, Ariz., about 15 miles northeast of the city of Safford and contains about 70 square miles (fig. 1). Altitudes range from about 3, 200 feet on the Gila River to about 7, 000 feet at Turtle Mountain. The area includes the lower 15 miles of Bonita Creek.

This report is based on an investigation of the geology and ground-water resources of the area made by the U. S. Geological Survey in cooperation with the city of Safford.

GEOLOGY

The lower Bonita Creek area includes the southeasternmost part of the Gila Mountains, the western slopes of Turtle Mountain, and the dissected valley between them (fig. 1). The mountains are tilted fault blocks composed predominantly of volcanic rocks, and the valley area is underlain principally by dissected alluvial deposits. The rocks range in age from probably Cretaceous to Quaternary. Age designations are made on the basis of lithologic similarity to or continuity with rocks of known or accepted age. No fossils have been found in this area.

STRATIGRAPHY

Cretaceous(?) Undifferentiated Rocks

Undifferentiated sedimentary, volcanic, and intrusive rocks of probably Cretaceous age crop out in small, discontinuous exposures. Light-colored sandstone, green and red mudstone, and black muddy limestone crop out at the south end of the Cretaceous (?) exposures along Midnight Canyon. Well-indurated siliceous and andesitic volcanic rocks are exposed along the slopes of the Gila Mountains and are associated with lithic graywacke and poorly sorted conglomerate. They are predominantly gray-green to gray-purple. Along the western front of the Gila Mountains, the Cretaceous (?) volcanic rocks are intruded by fine-grained porphyries and are extensively epidotized and locally mineralized. The stratigraphic relationship between the sedimentary and volcanic rocks is not known.

Tertiary(?) Rocks

Volcanic and sedimentary rocks of Tertiary (?) age comprise a large part of the exposed rocks in the lower Bonita Creek area (fig. 1). These are separated into four units; the three lower units are predominantly volcanic and the upper unit is predominantly an alluvial conglomerate composed of volcanic fragments. The volcanic units unconformably overlie Cretaceous (?) rocks.

The lower volcanic unit is composed predominantly of brickred to gray andesitic flows and lesser amounts of tuffaceous breccia and agglomerate and some interbedded conglomerate lenses. Locally the basal member is a conglomerate containing many fragments of gray tuff and a few fragments of Cretaceous (?) volcanic rocks. This unit is up to about 1, 250 feet thick.

On the slopes of Turtle Mountain, where the middle volcanic unit is best exposed, the unit consists of about 900 feet of rhyolitic and felsitic flows and tuffaceous sediments. Flows of andesite and beds of andesitic agglomerate and cobble conglomerate are interbedded locally in the unit. Elsewhere the middle unit is much thinner, owing in part to erosion occurring before the deposition of the upper volcanic unit, and in part to original differences in thickness. Locally, the middle volcanic unit is completely missing.

The presence of tuffaceous members in the lower unit and andesitic members in the middle unit suggests that the two units represent one general period of volcanic activity.

Thin, evenly bedded andesite flows form the principal part of the upper volcanic unit. The andesite is light to dark gray or grayish purple and is marked by well-developed flow breccias at the bottom and top. There are a few discontinuous conglomerate lenses, especially near the top of the section. The maximum thickness of the upper volcanic unit in the area is about 1, 200 feet.

In general, the two lower volcanic units appear to be conformable, although locally, as in upper Coyote Canyon, the contact between them is angular. The upper volcanic unit generally rests with a small angular unconformity on an erosion surface cut on the two lower volcanic units. Where the middle unit is absent, it is difficult to distinguish between the lower and upper volcanic units. Local erosional and angular unconformities exist within each of the volcanic units, and particularly within the lower and middle units.

The three volcanic units are roughly the equivalent of the threefold sequence of older Tertiary volcanic rocks briefly described by Bromfield and Shride (1956 p. 627), and are probably equivalent to the upper part of the Clifton volcanic series described by Lindgren (1905).

The uppermost flows of the upper volcanic unit are intercalated with lenses of conglomerate along the Gila River, and there is a zone of transition between the volcanic unit and the overlying sedimentary unit. Locally, the contact between the uppermost flows and the predominantly sedimentary unit above is a well-developed erosion surface having as much as 20 feet of relief.

The sedimentary unit of the Tertiary(?) rocks is a moderately thick conglomerate composed largely of volcanic gragments of Tertiary(?) age. Locally the basal unit is a tuff, and thin layers of tuff are interbedded with the conglomerate. The lower part of the unit is well indurated, but the degree of induration decreased upward in the section and the upper part, although capable of standing in nearly vertical cliffs, is poorly consolidated. The unit is more than 700 feet thick in the southeastern part of the area, but northward and northwestward it feathers out into unconsolidated rubble on underlying volcanic rocks.

The upper part of the volcanic conglomerate in most areas underlies the present erosion surface, except along the Gila River where it is disconformably overlain by the Tertiary and Quanternary conglomerate and Quaternary alluvial deposits.

At the mouth of Bonita Creek, the Tertiary(?) conglomerate unit includes the lower 300 feet of one of the type sections of the Gila conglomerate as described by Gilbert (1875). The lower 300 feet of Gilbert's section is separable from the upper part by an abrupt change in composition. The two parts are conformable and appear to be transitional, although to the west, at the south end of the Gila Mountains, the relief between the lower and upper parts of the section is as much as 200 feet. The Tertiary(?) conglomerate tentatively is considered to be no younger than late Pliocene and probably no older than early Pliocene, on the basis of the age of the overlying strata and the regional geology.

Tertiary and Quanternary Rocks

The conglomerate forming the upper part of Gilbert's type section of the Gila conglomerate is here referred to as the Tertiary and Quaternary conglomerate. It is extensively exposed on bluffs along the Gila River within the area mapped. The Tertiary and Quanternary conglomerate is composed predominantly

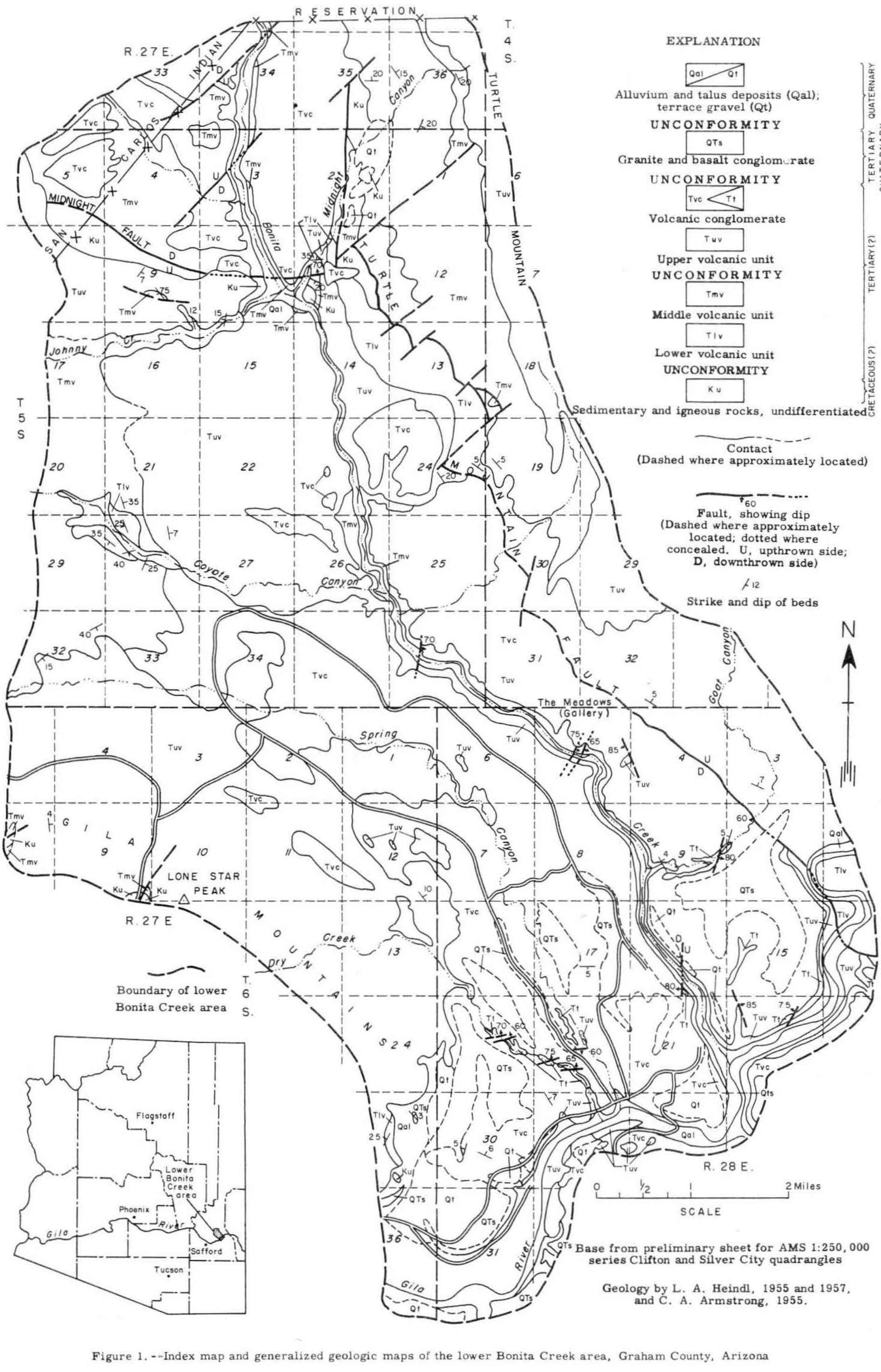

Figure 1.--Index map and generalized geologic maps of the lower Bonita Creek area, Graham County, Arizona

of basaltic and felsitic fragments, but is distinguished from the underlying Tertiary(?) conglomerate by the inclusion of red granite and light-colored quartzitic fragments and by being generally less well indurated. The granite fragments, although uncommon, are conspicuous because of their red color.

The Tertiary and Quaternary conglomerate is essentially horizontal and overlaps onto the Tertiary(?) conglomerate and older volcanic rocks in the southwestern part of the area. The maximum thickness in the area mapped is about 400 feet. Locally the beds are in part cut by, and in part overlap, the Turtle Mountain fault.

The Tertiary and Quarternary conglomerate interfingers with and grades into finer grained deposits in the Safford Valley. The finer grained deposits were shown by Van Horn (1957, Late Cenozoic beds in the upper Safford Valley, Graham County, Arizona: Univ. of Arizona, Tucson, unpublished master's thesis) to contain late Pliocene and Pleistocene fauna, stratigraphically within 100 feet of each other.

Quaternary Rocks

Alluvial deposits of Quaternary age include terrace and talus deposits, pediment gravels, and flood-plain and channel deposits along the Gila River, Bonita Creek, and their tributaries.

Structure

The principal structural features of the lower Bonita Creek area are the northwest-trending fault blocks that form the Gila Mountains and Turtle Mountain. The two blocks are tilted slightly to the northeast, and the Gila Mountain block in the area mapped has a low component of dip to the southeast. Folding is minor compared with faulting, but some small-scale folds occur within the Tertiary(?) volcanic rocks, and the Tertiary(?) conglomerate is warped into a broad syncline that plunges gently to the southeast. The structural history prior to the deposition of the Tertiary(?) volcanic rocks is obscure. The deformation involving the Tertiary(?) rocks occurred in three stages.

The first stage is older than the upper volcanic unit and includes local deformation of the lower and middle volcanic units. This period of deformation is recorded in the northern part of the area where a fault brings Cretaceous(?) rocks and rocks of the middle volcanic unit into contact. The west end of the fault is covered by flows of the upper volcanic unit. Subsequent movement along this fault is shown by juxtaposition of the Tertiary(?) conglomerate against rocks of the middle volcanic unit near the mouth of Midnight Canyon. At its east end the fault is apparently cut off by the younger Turtle Mountain fault zone.

The second stage of deformation occurred locally after the eruption of the upper volcanic unit and before the deposition of the Tertiary(?) conglomerate. Faults of this period of movement are well exposed along Bonita Creek, where northeast-trending faults within the upper volcanic flows show displacements of about 30 feet, the downthrown sides being to the southeast. Here, the volcanic conglomerate was deposited on an erosion surface truncating the fault trace.

The third stage of deformation is younger than the Tertiary(?) conglomerate. During this stage the main movement along the northwest-trending Turtle Mountain fault occurred, uplifting the Turtle Mountain mass relative to the Gila Mountain block. The Tertiary(?) conglomerate on the back slope of the Gila Mountain block was warped into a broad syncline that plunges at a low angle to the southeast. The dips on the Tertiary(?) conglomerate differ only slightly from what may have been their original attitude. Movement along the Turtle Mountain fault continued late enough to cut some of the lowest beds of the granite and basalt conglomerate.

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