# PROGRESS REPORT ON INVESTIGATIONS OF SOME CRETACEOUS-TERTIARY FORMATIONS IN SOUTHEASTERN ARIZONA

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The term "Cretaceous volcanics" has been widely accepted for certain formations in southeastern Arizona, but comparatively little attention has been given these occurrences. The purpose of this brief paper is to record a few observations and interpretations which it is hoped will serve to stimulate more interest in Cretaceous-Tertiary rocks and their relationships.

During the course of geological work at the Silver Bell Mine it was noted that the lowest unit of Tertiary (?) volcanics of that area closely resembled W. H. Brown's[1] Cat Mt. Rhyolite of the Tucson Mts. and, that this unit rests on clastic breccias and conglomerates which, in turn, rest on an erosion surface cut in Cretaceous and older sediments. This surface was considered to mark a possibly important interval of erosion within the Laramide Revolution.[2] The formation overlying this surface (designated the Silver Bell formation) is somewhat distinctive in that it is composed mainly of angular to sub-rounded fragments of dark gray to purplish-hued andesite porphyry enclosed in a matrix of gritty andesitic mudstone. The fragments are commonly on the order of one to six inches in diameter, but large blocks, or boudlers, several feet in diameter occasionally are present. Evidence of stratification is extremely rare. Varying in thickness from a few feet to possibly 200 feet, it appears to lie unconformably on Cretaceous and older sediments, although actual contacts were not observed. A good exposure of the contact with the overlying volcanics was found about one mile north of the Oxide pit. There, the two formations are separated by a thin bed of well rounded cobbles of various rocks, including alaskite and limestone.

Subsequently, clastic breccias closely resembling those of the Silver Bell formation were noted in a number of localities, particularly in the Twin Buttes area to the southeast of Silver Bell and in the Stanley and Winkleman-Christmas areas to the northeast.

West of Silver Bell, in the Reward mine area, L. A. Heindl[3] observed occurrences of "andesite porphyry conglomerate, or purplish volcanic breccia" which he regarded as similar to those at Silver Bell.

Although the evidence accumulated so far is somewhat scanty, it is considered to suggest strongly that these breccias with their interbedded conglomerates (and volcanics?) comprise a formation of considerable extent, the deposition of which marked the beginning of a major period of volcanic activity. And, although this activity may have begun before the close of Cretaceous time, this formation should be regarded as separate from underlying Cretaceous sediments. The accompanying chart shows probable relationships with older and younger rocks in various localities, and possible correlations.

In the Tucson Mts., approximately 25 miles southeast of Silver Bell, a formation termed the Tucson Mtn. Chaos by John E. Kinnison,[4] is composed in part of material

eroded from a formation of the Silver Bell type. It is characterized principally by an abundance of large angular blocks of limestone, arkose, andesite porphyry conglomerate and other rocks. In an exposure one-half mile due south of Gates Pass the chaos consists of erratically positioned large rock blocks enclosed in a series of thin bedded conglomerates and silts having moderate easterly dips. The overlying pyroclastics (and ignimbrites?) of the Cat Mt. rhyolite formation also dip easterly, but at somewhat lower angles. The chaos appears to overlie unconformably arkosic beds of probable Cretaceous age, an interpretation which is not in accord with that of W. H. Brown[1] who, in this area and others, regarded the formation (herein referred to as chaos) as a pre-Amole-Recreation Red Beds volcanic of Cretaceous age.

In the Twin Buttes vicinity, a short distance southeast of the Duval Sulphur Company's millsite, continuous exposures of a formation of the Silver Bell type suggest a total thickness of possibly 2000 feet or more. The boulders are mostly angular, but well-rounded cobbles are common. Occasional thin, pebbly horizons have northeasterly strikes and southeasterly dips. Relationships with older and younger rocks are uncertain; however, the formation appeared in one exposure to be underlain by arkosic rocks, and in other exposures to be overlain by volcanics resembling the Cat Mt. rhyolite.

At the Flux Mine in the Patagonia Mts., about 35 miles southeast of Twin Buttes, Lower (?) Cretaceous beds are overlain unconformably by a coarse conglomerate containing an abundance of alaskite boulders which are considered to have been eroded from a nearby alaskite mass. The alaskite intrudes Cretaceous beds. And, since rocks younger than the conglomerate (the Chief formation and an overlying andesite flow) are cut by monzonite porphyry, the conglomerate appears to represent a post-Cretaceous interval of erosion separating two Laramide-type intrusives.[2] The alaskite-bearing conglomerate apparently occupies a position in the sequence equivalent to that of the Silver Bell type in other localities.

In the Stanley area, about 70 miles northeasterly from Tucson, Silver Bell-type clastic breccias and conglomerates make up a series of considerable thickness (± 2000 ft.) and extent. The base is well exposed on the road to the Princess Pat Mine, near a ridge crest 2 miles southeast of Stanley. There it overlies, with apparent conformity, a series of thin-bedded siltstones, shales and quartzites, designated as upper Cretaceous in age by C. P. Ross.[5] A few feet of pale greenish, silty (tuffaceous?) grit occur immediately below the clastic breccias, while in Hawk Canyon, at a point four miles westerly from Stanley, a conglomerate composed predominately of well-rounded quartzite cobbles lies at the base. On the southwest side of Hawk Canyon the Silver Bell type formation is capped by volcanics. Although this formation was not observed in place, float lying a short distance below the contact bears a textural resemblance to the Cat Mountain rhyolite.

In the Winkleman-Christmas area, 20 miles west of Stanley, the Silver Bell-type formation rests on Paleozoic limestones. About 2 miles northwesterly from the mouth of O'Carrol Canyon excellent exposures of the contact occur. There, the two formations, separated by a few feet of pale green, sandy siltstone, appear to be generally conformable; however, unconformable relationships are indicated in adjacent areas by aerial photo patterns.

Ross[5] regarded the rocks overlying the Paleozoic limestones east of Winkleman, and in the Stanley area, as a continuous series of volcanics and clastics of upper Cretaceous age. Fossil evidence was confined to a lower member of the series of sandstones, siltstones and shales in the Stanley area, but beds of similar lithology (and age) were considered by Ross to occur within the overlying volcanics.

There is, admittedly, some question as to the identity of this overlying formation (the Silver Bell-type) -- it may in part be properly termed "volcanic". However, in the matter of age, if interbeds lithologically comparable to the underlying series exist, they were not recognized; in the writer's opinion the various rocks of this group comprise a distinctly separate formation representing a pronounced shift in the course of geologic events, which may have occurred late in Cretaceous time, or very early in the Tertiary period. Possibly, andesite porphyry debris was dumped into shallow Cretaceous seas in the Stanley area, while farther west it was deposited on erosion surfaces cut in various earlier formations. It probably did not extend north as far as Ray; if so, it was removed by pre-White Tail conglomerate erosion.

In only one locality -- east Silver Bell -- have possible source rocks been observed. There, in places, the Silver Bell formation rests on a massive porphyry identical in appearance to the overlying boulders. This porphyry may be of intrusive origin as it resembles other porphyries in the area which are known to be intrusives; however, the great areal extent of some of the Silver Bell-type occurrences (over a hundred square miles in the region east of Winkleman) suggests rather strongly a close relation to extrusive, rather than intrusive, rocks.

## REFERENCES


(1) W. H. Brown: Tucson Mountains, an Arizona Basin-Range Type, G.S.A. Bull (1939) Vol. 50, pp. 697-760.

(2) Kenyon Richard and J. H. Courtright: Structure and Mineralization at Silver Bell, Arizona, Mining Engineering, Nov., 1954, pp. 1095-1099.

(3) L. A. Heindl: Unpublished Memorandum. Cretaceous (?) and Cretaceous Tertiary Units, Papago Reservation, Jan. 16, 1956.

(4) John E. Kinnison: Unpublished M.S. thesis, Univ. of Arizona, 1958. The Geology and Ore Deposits of the Southern Section of the Amole Mining District, Tucson Mts., Pima County, Arizona.

(5) C. P. Ross: Geology and Ore Deposits of the Aravaipa and Stanley Mining Districts, Graham County, Arizona (1925) USGS Bull 763, pp. 25-28.


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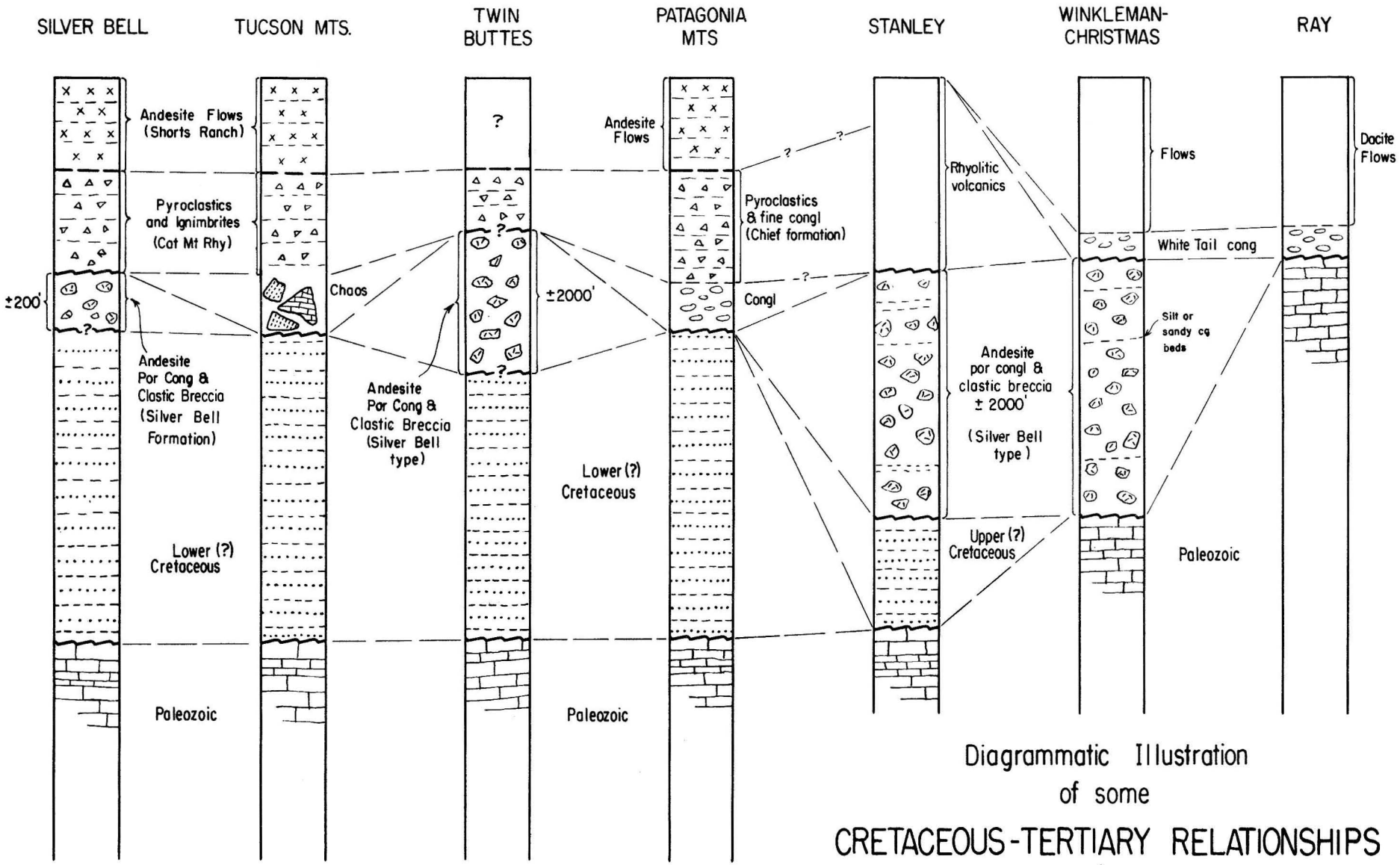


Diagrammatic Illustration
of some
# CRETACEOUS-TERTIARY RELATIONSHIPS
in
# SOUTHEASTERN ARIZONA
## NOT TO SCALE

J.H.C.

April, 1958

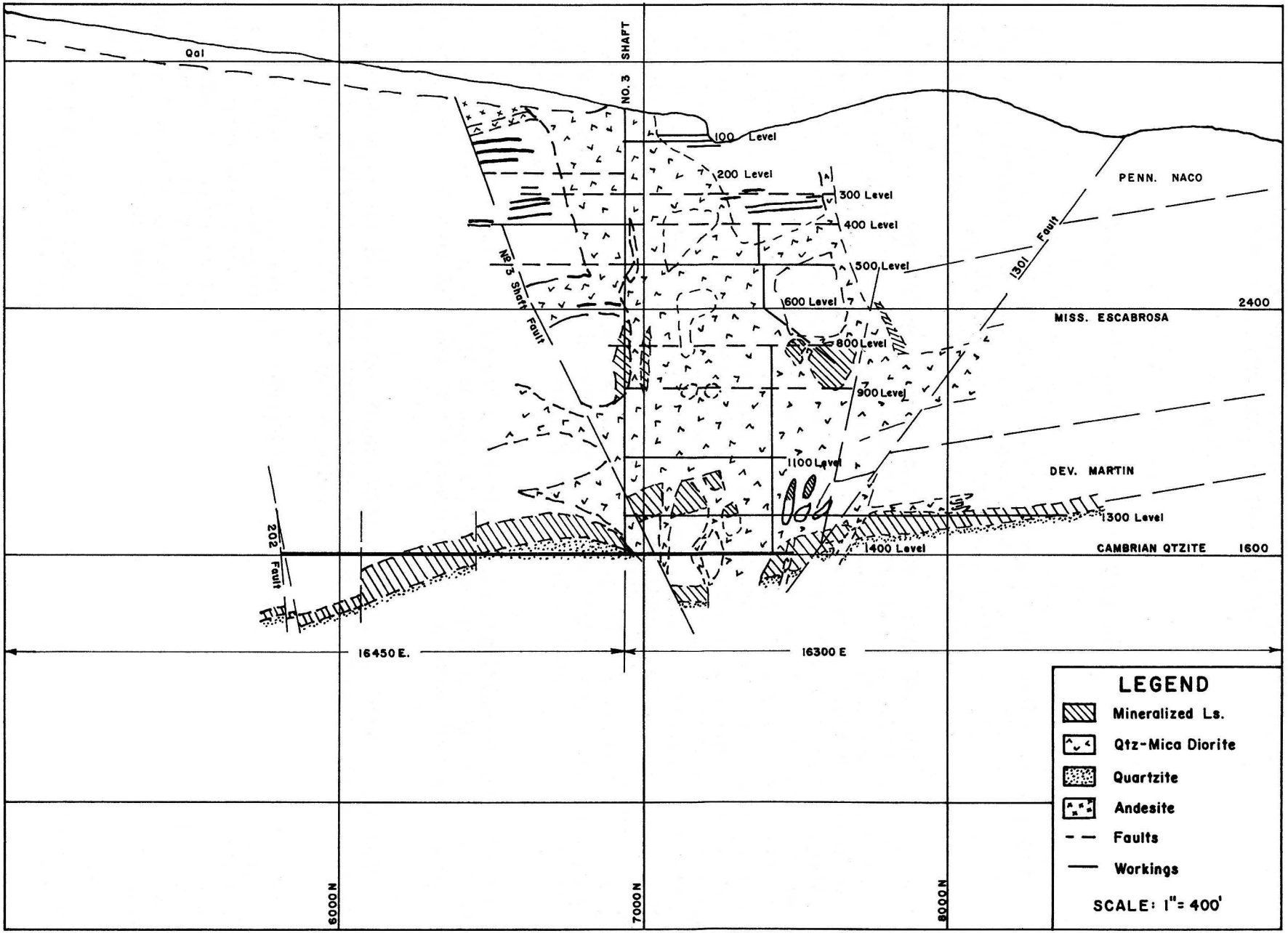


PLATE 5, GENERALIZED N-S SECTION THRU NO. 3 SHAFT, LOOKING WEST; CHRISTMAS MINE