QUATERNARY GEOLOGIC MAP OF THE CORONA DE TUCSON 7.5' QUADRANGLE, ARIZONA

by

Garrett Jackson

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Arizona Geological Survey
416 W. Congress, Suite #100, Tucson, Arizona 85701

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EXPLANATION

GEOMORPHIC SETTING

The Corona de Tucson quadrangle is located about 15 miles southeast of Tucson. Dominating the quadrangle are the northern Santa Rita mountains and part of an extensive piedmont flanking the northwest side of the range. Only isolated patches of Quaternary alluvium can be found in the mountains, occurring in the larger canyons. Colluvium is common, but was not mapped here.

The piedmont contains a wide variety of ages of fans. Alluvial fans make up the surface of the piedmont, with only a few inselbergs and exposed patches of bedrock pediments. Being spatially separated from the effects of regional downcutting, no basin terraces have formed here, as in the central Tucson Basin (see Jackson, 1989 and McKittrick, 1988). Although significant altitudinal separation exists between fans of different ages near the mountain front, this separation decreases basinward. On the west side of map area, all ages of fans can be found adjacent to each other, with little, if any, vertical separation. All units in this area are thin veneers over older deposits or each other. In addition, older deposits are stripped to different degrees.

In the western portion of the study area, the transition between an alluvial fan regime and discontinuous ephemeral streams occurs. As the gradient of the piedmont decreases, streamflow becomes unconfined and sediment is deposited. Sheetflow begins to dominate (however, historic arroyo-cutting has channelized much of the flow across the piedmont). With no well-defined drainage divides or channels, loci of deposition (alluvial fans) become increasingly diffuse, and become "intertwined" with patches of older units on the piedmont. The flow regime then becomes a discontinuous ephemeral stream (Packard, 1975). In this regime, the drainages experience infrequent flow. During a flow event, parts of the drainage experience sheetflow and deposition, while some parts experience channelized flow and headward erosion.

In the north-central and northwest portions of the quadrangle, large areas of M1 and M2 have escaped veneering. This may be because the drainage areas for streams on the piedmont include little of the mountain range.

The west-central portion of the map is adjacent to the central part of the range and probably receives more sediment input and stream flow because more of the mountain range drains onto the adjacent piedmont. In addition, the discontinuous ephemeral streams are more extensive than to the north, in the Tucson SE quadrangle (Jackson, 1989).

Pediments

Pediments are subplanar erosional surfaces found adjacent to the mountain front. They may be formed in alluvium or bedrock and generally slope gently toward the valley. Typically they are veneered by alluvium that increases in thickness toward the valley floor. The Corona de Tucson quadrangle contains an extensive pediment flanking the Santa Rita mountains. It is defined by the mountain front on the east and by the line of fault scarps on the west. The fault scarps are an expression of the range-bounding fault, otherwise buried from view. Exhumed pediment appears in the eroded apices of some of the oldest fans (O), but the depth to the pediment further from the mountain front is unknown. To the northeast of the quadrangle, Eberly and Stanley (1978) suggest, through interpretation of seismic profiles, that a pediment lies buried about 800 m below the surface. This would indicate a slope of about 15°. This inclination is high for a pediment, at least by modern standards. The pediment in the Corona de Tucson quadrangle is probably somewhat more shallow than 800 m.

Debris flow and earthquake hazards

Within the mapped area, debris flows do not appear to occur frequently. Although some steep slopes are present, the mountains are well-vegetated and low in altitude. Some historic boulder berms can be found 2 km from the mountain front, but they may be water-laid, as no matrix is present.

A line of fault scarps related to the range-bounding Santa Rita fault cut alluvium in a southwest-northeast strike. Pearthree and Calvo (1987) estimated that the most recent surface rupture occurred about 100,000 years ago. Prior to that, a surface-rupturing earthquake occurred at about 200, 000 years ago. Though not precisely known, the recurrence interval for earthquakes appears to be very long, on the order of 100,000. This makes the probability of a large-magnitude earthquake occurring in the near future very low.

GEOMORPHIC CRITERIA FOR LANDFORM CLASSIFICATION

After a depositional surface is abandoned, geomorphic processes cause progressive, systematic changes in the surface and soil morphology with time. Relative ages can be established from differences in these morphologies Criteria can be classified into three groups: altitudinal, topographic, and pedogenic.

Incision of the Tucson Basin began during the latest Pliocene and continues to the present. This allow altitude to be used as an indicator of age. When stream power is enhanced by climatic change, downcutting occurs. Stream and fan terraces represent periods of lateral planation or deposition by streams. The younger terraces are lower than the older terraces.

When a surface becomes isolated from active deposition, degradation begins immediately. On alluvial fans, this begins with infilling of bar and swale topography. The surface becomes more smooth. As this smoothing occurs, downcutting in the distal reaches of the fan, perhaps caused by downcutting of drainages near the fan, leads to headward erosion in the fan itself. Gradually a tributary stream system develops, the reverse of the distributary pattern of an active fan. The divides between the fan channels, or interfluves, have flat crests and sharp banks initially. These may also be termed fan terraces. With time, the fan terrace scarp degrades and becomes less steep. The result is a rounded interfluve. The channel itself is modified through time. Initially, channels are V-shaped and narrow. As tributary drainage nets develop and lengthen, the channels become large enough to carry their own channel deposits, usually medium to coarse sand. The oldest fan surfaces are usually remnants of interfluves.

Another indicator of surface age is soil development. Many soil properties have been shown to change systematically with time. In this study area, gross changes in soil morphology have been noted on a reconnaissance basis to make distinctions between the major surfaces. The most basic characteristic is development of an argillic horizon, which generally indicates a Pleistocene age. Presence, thickness, and morphology of carbonate horizons can also used (Bachman and Machette, 1977). The oldest surfaces have thick petrocalcic horizons (K) and often this is the only part of the soil preserved. Thick laminations on the top of the K horizon indicate great antiquity (eg., Typic Paleorthid). Pearthree and Calvo (1987) examined soil development and surface morphology of the piedmont units to the south, near the Madera Canyon fan. Their units are correlated to the Corona de Tucson units in the unit descriptions above.

SYMBOLS

Alluvial units

Contact; dashed where gradational; queried where uncertain.

Fault scarp; dashed where approximate; queried where uncertain.

Basinward boundary of bedrock pediment.

ch Active, confined stream channels. Correlates to unit Q4 of Pearthree and Calvo (1987).

Y2 Active and recently active alluvial fans and deposits. Includes poorly confined and/or anastomosing channels. No soil development. Bar and swale topography prominent; historical slag fragments common. No stream incision has occurred. These fans experience frequent stream flow and sediment transport, and they occupy the lowest topographic positions, commonly veneering older deposits. Sparsely to unvegetated. Correlates to unit Q4 of Pearthree and Calvo (1987).

Y1 Early to middle Holocene alluvial fans. Weak to moderate soil development; maximum carbonate development is stage II+. Bar and swale topography strongly expressed. Fans lie up to 1.5 m above active channels. May experience infrequent overflow locally from active channels and some transport of mostly fine-grained sediments. Well vegetated. Correlates to unit Q3 of Pearthree and Calvo (1987).

M2 Late Pleistocene to early Holocene alluvial fans. Soils moderately developed. Maximum carbonate is stage III. Incipient rubification and clay accumulation. Bar and swale topography subdued in coarse-grained alluvium, absent in fine-grained alluvium. The fans lie up to 3 m above active channels. Stream flow and sediment are confined to drainages. Large areas of M2 are present in the north and west portions of the quadrangle. Interfluves are flat-crested; streams developed on the fan surfaces have a low width to depth ratio. Correlates to units Q2c and Q2d of Pearthree and Calvo (1987).

M1 Middle to late Pleistocene alluvial fans. Soil is well developed; maximum carbonate stage is IV. Rubification is strong and there is a well-developed argillic horizon. Surface is planar. The fans lie up to 7 m above active channels. This unit is widespread, appearing extensively underlying younger units as well as at the surface. Displaced by the Santa Rita range-bounding fault. Interfluves are moderately rounded; streams developed on the fan surfaces have a moderate width to depth ratio. Correlates to unit Q2b of Pearthree and Calvo (1987).

O Early to middle Pleistocene alluvial fans. Soil is well-developed, with a thick argillic horizon, but has been removed by erosion from much of the surface, exposing carbonate-coated clasts. Thick carbonate horizons have stage IV development. A litter of pieces of the petrocalcic horizon is common. Rubification very strong. The fans lie up to 15 m above active stream channels. Displaced by the Santa Rita fault. Interfluves are well-rounded; streams developed on the fan surfaces have a high width to depth ratio. Dissected fans are commonly cored by bedrock. Correlates to unit Q2a of Pearthree and Calvo (1987).

Bedrock units*

Tg	Tertiary granites and related rocks..
Kc	Cretaceous clastic sedimentary rocks.
T	Triassic clastic sedimentary rocks.
P	Permian limestones.
P P	Pennsylvanian-Permian limestones.
P	Pennsylvanian limestones.
M	Mississippian limestones.
DM	Devonian-Mississippian limestones.
D	Devonian limestones.
c	Cambrian clastic sedimentary rocks.
p g	Precambrian granites and related rocks.

*Bedrock geology from Drewes (1971).

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