



Lithology and stratigraphy of the Supai Formation, Fort Apache Indian Reservation, Arizona

Stephen S. Winters

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LITHOLOGY AND STRATIGRAPHY OF THE SUPAI FORMATION FORT APACHE INDIAN RESERVATION, ARIZONA

STEPHEN S. WINTERS

Florida State University, Tallahassee, Florida

INTRODUCTION

The Fort Apache Indian Reservation in eastern Arizona is a region of rugged, forested areas in the eastern and northern portions that give way to lower elevations and relatively low relief in the south. South- and west-flowing streams in the east and north are actively cutting steep-walled canyons in thick lava flows and underlying sediments. The southern boundary of the Reservation is the Salt River, into which the streams traversing the Reservation flow. Although strata ranging in age from Cambrian to Cretaceous underlie the Reservation, rocks of Permian age, particularly the Supai Formation, are predominant in the area.

Through the years, since Darton (1910) first named it in the Grand Canyon region, investigators have, with varying degrees of success, tried to piece together the stratigraphic relationships of the Supai Formation. In recent years a number of attempts have been made to revise the position of both the upper and lower boundaries, to variously subdivide it into members (Hughes, 1952; Jackson, 1951; Winters, 1951) and to restrict the use of the name in various parts of Arizona (Baars, 1962).

Detailed stratigraphic sections measured within the Reservation permit the description of a composite section for the Supai Formation.

SUPAI FORMATION

General Statement

As recognized within the Reservation, the Supai Formation consists of four members with a combined thickness of about 1300 feet. It overlies, with apparent conformity, the Naco Limestone of Virgil (Pennsylvanian) age. The lower contact of the Supai can be seen along Amos Wash about three miles north of its junction with White River.

The Coconino Sandstone rests with apparent conformity on the uppermost member of the Supai, and can be seen west of U. S. 60 in the upper portion of a long slope about six miles northeast of the Carrizo Creek bridge.

The formation, as in most of its exposures in Arizona, is characterized by a thick red-bed sequence. This sequence, within the Reservation, is locally interrupted by thin gypsum beds of short lateral extent, light-colored claystones and several limestone units, only one (Fort Apache Limestone) being of considerable thickness. Detailed descriptions as well as formal naming of the members will appear shortly in a publication of the Geological Society of America.

Amos Wash Member

The lowest member consists of about 330 feet of reddish-brown fine-grained sandstone and siltstone with small-scale cross bedding. It is well exposed along Amos Wash south of the connecting road between U. S. 60 and Arizona 73.

Big A Butte Member

The next younger member (about 475 feet thick) contains numerous stringers and beds of gypsum, as well as thin limestone and calcareous claystone units, interbedded with the dominant reddish-brown mudstones and siltstones which form ledge and slope topography. Channel-fill deposits are exposed locally. This member is best

exposed one mile southeast of the village of Whiteriver in the slopes of a butte capped by Fort Apache Limestone.

Fort Apache Limestone Member

The Fort Apache Limestone is a wide-spread, easily recognized, cliff-forming unit whose maximum complete thickness is 120 feet. It is gray, medium- to thin-bedded, and contains an abundant molluscan fauna. Undoubtedly this is the most distinctive unit in the Reservation. There are accessible outcrops along the road to Cibecue 3.5 miles west of U. S. 60, and also along the East Fork road 10 miles east of Whiteriver. Elsewhere on the Reservation it is well exposed but not easily reached.

Corduroy Member

This member is about 370 feet thick, similar in lithology to the Big A Butte Member, and best exposed west of U. S. 60 about 6 miles northeast of Carrizo Creek Bridge. The topographic expression of the upper three members plus the overlying Coconino Sandstone at this locality is shown on Fig. 1.

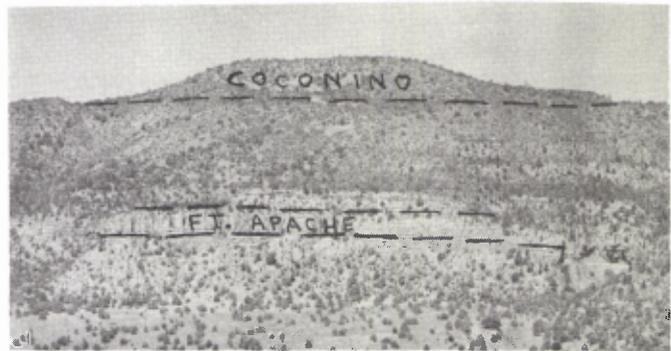


Figure 1. Exposure of Coconino Sandstone and upper three members of Supai Formation west of Corduroy Creek.

DEPOSITIONAL ENVIRONMENT

During Pennsylvanian-Permian time, the area of the present Fort Apache Indian Reservation was part of the transitional environment of deposition between dominantly marine conditions in southeastern Arizona and dominantly non-marine conditions in the Grand Canyon region.

After deposition of the Naco carbonates and interbedded clastic sediments in eastern Arizona, withdrawal of the sea toward the south and southeast was accompanied by widespread deposition of flood plain-deltaic red beds. Channels were scoured and filled at various times and places, as is indicated by deposits of the Big A Butte Member (Fig. 2). The Zuni-Defiance uplift was probably the main source for these clastics. Thin gypsum deposits of restricted lateral extent within the red-bed sequence probably resulted from evaporation in shallow catchment basins on the floodplain-delta complex.

Minor incursions of the sea during subsidence of the region resulted in accumulation of thin, unfossiliferous limestone units. The only important transgression of the sea during the development of the Supai deposits is represented by the Fort Apache Limestone Member. At its

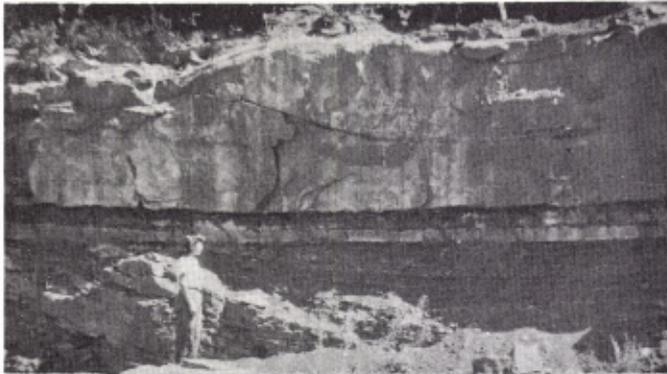


Figure 2. Channel-fill deposits in Big A Butte Member one mile southeast of Whiteriver.

greatest extent, the sea spread beyond Oak Creek Canyon, about 125 miles northwest of the village of Fort Apache. The molluscan fauna suggest a shallow marine environment. The fossils are silicified and excellently preserved. Productid brachiopods have fragile spines intact, and growth lines and delicate ornamentation are well preserved on many of the shells. Even fragments show little or no wear, suggesting quiet bottom conditions and the work of scavengers rather than vigorous current and wave action.

The increasing clastic content and thinning of the limestone to the west and northwest indicate the directions of marine advance and retreat. At Oak Creek Canyon, the limestone is unfossiliferous and only 10 feet thick. It is about 430 feet below the top of the Supai.

REGIONAL CORRELATION

It is certain that the lower boundary of the sequence of beds called Supai varies in age within the region be-

tween the Reservation and Oak Creek Canyon, and probably beyond. The upper limestone in the Naco within the Reservation contain Virgilian fusulinids. The unfossiliferous red-bed sequence overlying the Naco is believed to be Wolfcampian. The Naco at Oak Creek Canyon has been dated as Desmoinesian (Jackson, 1951). It is likely that all of the Supai within the Reservation is equivalent to only the upper, A Member at Oak Creek Canyon.

The Fort Apache Limestone fauna is most like faunal elements of Leonardian Age in the west Texas region. To the south, the Colina Limestone, with a fauna dated as Wolfcampian-Leonardian, has been correlated with the Fort Apache Limestone (Sabins, 1957). Similar lithologies and sequences, as well as faunal similarities, suggest a correlation with the Abo-Yeso sequence in central New Mexico (Winters, 1951). The Supai-Coconino contact, gradational across the state, is nowhere younger than Leonardian.

Regional relationships as well as lithologic variations are indicated by the generalized section of the Supai Formation between southeast Arizona and Grand Canyon (Fig. 3).

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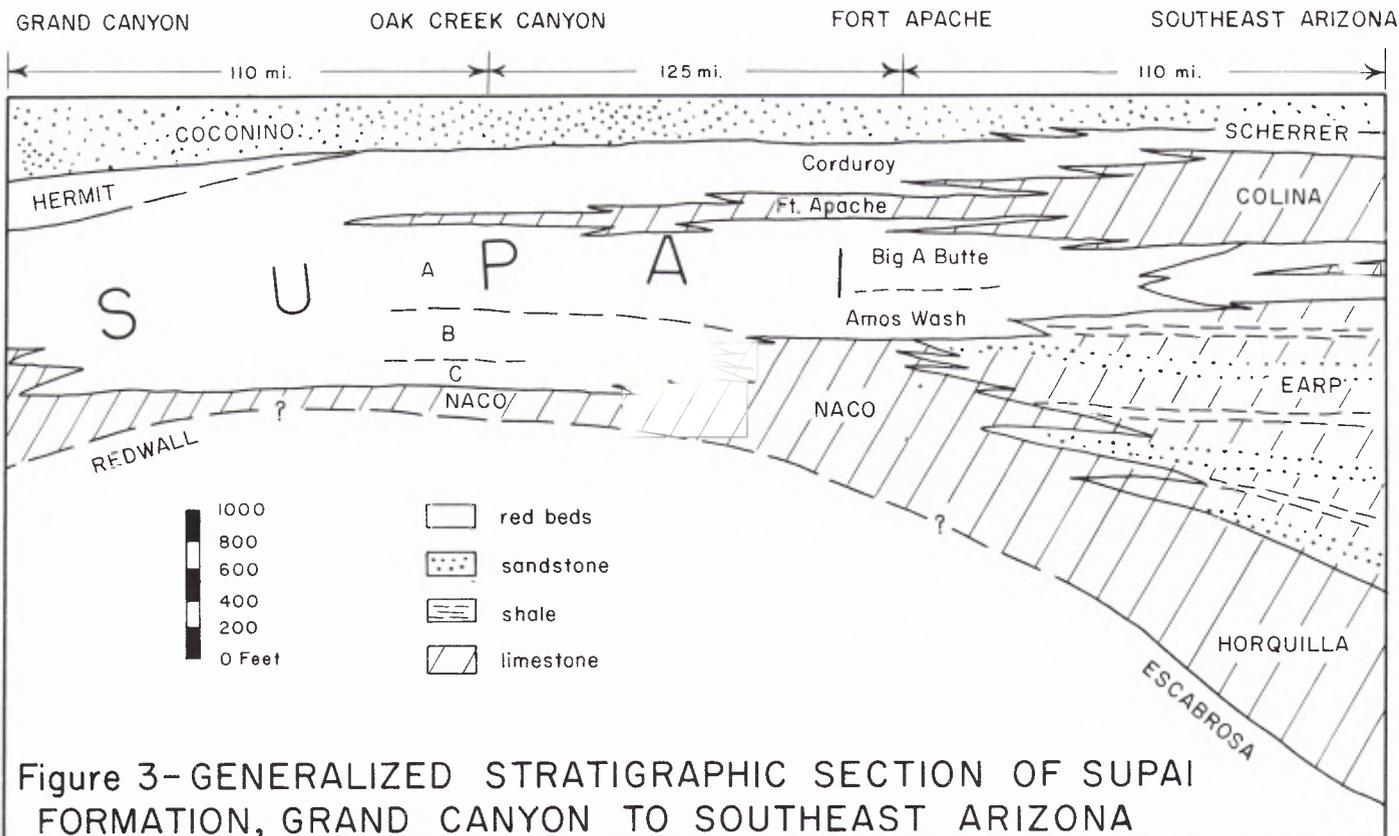


Figure 3-GENERALIZED STRATIGRAPHIC SECTION OF SUPAI FORMATION, GRAND CANYON TO SOUTHEAST ARIZONA