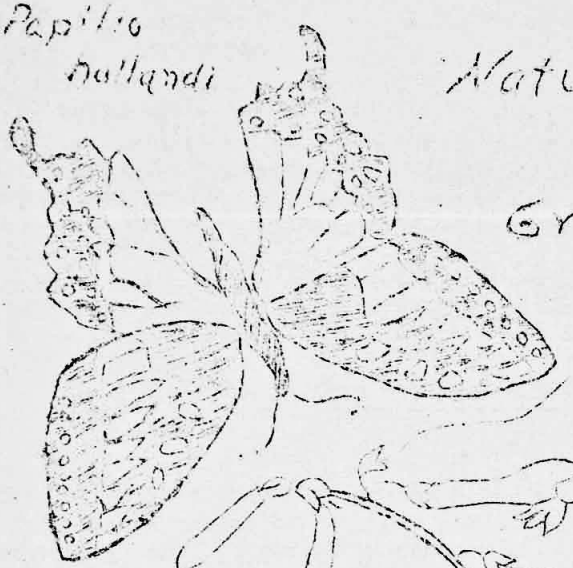

Nature Notes of Grand Canyon

Vol. 2 — No. 2

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U. S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
GRAND CANYON NATIONAL PARK

VOL. 2. NO. 2.
GRAND CANYON NATURE NOTES JULY 20, 1927.

This bulletin is issued monthly for the purpose of giving information to those interested in the natural history and scientific features of the Grand Canyon National Park. Additional copies of these bulletins may be obtained free of charge by those who can make use of them, by addressing the Superintendent, Grand Canyon National Park, Grand Canyon, Arizona.

M. R. Tillotson - Superintendent. By-C. E. Sturdevant- Park Naturalist.

THE PAPILIO TRIBE OF BUTTERFLIES.

By - Edwin D. McKee.

The belief that the Grand Canyon National Park is blessed with a bountiful representation of Nature's painted, soaring creatures - the butterflies, is ably supported by members of the genus Papilio or Swallow-tail, America's largest butterflies. From this single group have recently been seen and collected three different species which are the representatives of a like number of distinct life zones, and which between them range over the entire territory formed by the Canyon's depth. Every one of these butterflies is exceptionally distinctive by its huge size - having a wing spread of more than three inches, and by its long tail and brilliant colors.

Starting in the inner or granite gorge in the vicinity of Bright Angel Creek and the Colorado river, one finds the semi-tropical climate and flora of the Lower Sonoran Zone and with it, as is to be expected, the fauna of a corresponding type. Here is seen in great abundance the gaudy Pipe Vine Swallow-tail (Papilio philenor) with beautiful iridescent wings of green and black. It is a most conspicuous figure as it flits about among the cottonwoods, where it lends much color to the scene.

Thence travelling up the Canyon's sides some fifteen hundred feet to the level of the broad Tonto Platform, one arrives at the Indian Gardens with their red-buds, willows, and other representatives of the Upper Sonoran flora. Here too are to be found many plants of the zones be above and below and accordingly the fauna characteristic of each. In these gardens therefore - for they are veritable garden spots of the desert, are congregated the butterflies of the genus Papilio, representative of three distinct life zones. Typical of the Upper Sonoran itself, is the beautiful but little known species (Papilio hollandi), a butterfly of metallic blue interspersed with brilliant yellow.

Then again passing higher -- this time from the upper Indain Gardens all the way to the lofty Coconino Plateau, following in general the precipitious courses of dried streams, one finds an abundance of that giant of the tribe - the mighty two-tailed Swallow-tail or Papilio daunus. One specimen collected from this section had a wing expansion of five and one-half inches, even greater than the type dimensions, and all are of huge size. There is little doubt but that this remarkable size, coupled with the brilliant yellow and black markings, and the double tails of the lower wings, more closely resembles some wonderful tropical bird than a mere butterfly. Thus in the Transition Zone, the upper walls of the Canyon, we have a real king of butterflies.

FORMATIONS EXPOSED AT THE GRAND CANYON.

By. G. E. Sturdevant.

With all of the important factors favoring a great canyon, present; such as water coming in a strong volume from a region of great rainfall, this river flowing through a great elevated plateau region, and finally the plateau region being semi-arid in climate thereby preventing the widening of valleys only extremely slowly, the Colorado river, acting in the capacity of carrying agent with the vast amount of sediment serving as the rasp or saw, has slowly worn one of the deepest gashes into the earth's crust. This gash has resulted in the exposure of one of the most interesting geological sections of the world.

The oldest rocks exposed in the walls of this important geological section are representative of the earliest eon of geologic time. They are composed of crystalline shhists, gneisses, and granitic rocks of Archean age. They are representative of the primordial earth's crust and might very well be termed the corner-stone of the continent. These rocks form the walls of the inner or granite gorge at the present time. The term "granite gorge", however, is a misnomer, for true granite does not occur within the park. All of the types of rock that make up the Archean series are hard and equally resistant to erosion, thereby giving a sharp, ragged V-shaped profile to the inner gorge. By their darker color, crystalline character, ragged profile, and lack of stratification, they are easily distinguished from the overlying sedimentary rocks. The Archean rocks were eroded or worn away at the top and submerged deep beneath the sea. They are separated by a profound unconformity or great time interval from the overlying sedimentary rocks.

When the seas came in sediments accumulated upon the smooth surface to a great depth. These sediments are composed of layers of sandstones, shales, and limestones and are known as the Grand Canyon series or Unkar - Chuar formations of Algonkian time. Some of the remains of the most primitive life found in the earth's crust, is found in these sediments. The fossils reveal the presence of simple plants known as "algae" long before the beginning of the Paleozoic or old life era. When sediments had piled up to a great depth, profound folding took place. This area was lifted high above the surrounding seas. Geologists believe that mountains comparable to the present day Alps were then present in this vicinity. The slow disintegrating forces

of nature, however, gnawed away at the high mountains until they were finally reduced to low-lying hills and valleys. This area was then submerged beneath the sea. The total thickness of these sediments will never be known, but 12,000 feet of sediments measuring over two miles in thickness still remain exposed above the Archean rocks. They have been tilted at such steep angles and worn away to such an extent that at no place do they extend vertically out a few hundred feet at the most. In places they are entirely missing.

The seas came in over this submerged area and deposited the Tonto Group of Cambrian age. The lowest member of the group, the Tapeats sandstone now makes the greater part of the Broad Tonto platform within the Canyon. Above this occurs the Bright Angel shale and Muav limestone. These three formations contain the remains of primitive marine forms of extinct life, such as invertebrate tracks, worm trails, shell fish, crustaceans, and sea weed impressions.

Two great time intervals followed which probably represents millions of years of time. The Ordovician, the time when armored fishes were dominant in the seas, and the Silurian, the time when lung fishes developed and when the scorpions became our first air breathers, are both missing in the walls of the Canyon. The Silurian is not found in any part of the state of Arizona, probably indicating an elevation above sea level during this long period. The Ordovician is found in other parts of the state and may have been deposited here but during the great time interval that followed it was slowly worn away as well as a part of the Muav limestone.

The next record in the walls of the Canyon is the occasional presence of Temple Butte limestone of Devonian age. The limestone is not continuous but instead occupies small erosional pockets at the top of the Muav limestone. This formation contains the remains of a primitive type of fish that depended upon its bony-skin armor for defense rather than upon speed.

The next formation is known as the Redwall limestone. This deposit of Mississippian age stands out as a true vertical wall some five hundred feet in thickness. Locally this limestone is known as the "blue lime." The red color is due to water leaching out the oxide of iron from the overlying formations and slightly coating the blue limestone. Marine waters must have contained abundant food material for the fossil forms of shelled animals indicate them as being large, fat, and well-fed.

Resting upon the Redwall limestone occurs a series of cliffs and slopes, making up a total thickness of eight hundred feet. This is the Supai formation of Pennsylvanian time. Some of the most primitive reptilian tracks are present in a massive bed near the center of the formation.

Above the Supai formation lies nearly three hundred feet of Hermit shale of Permian age. This formation is of interest for the abundant occurrence of well-preserved animal tracks, ancient plant impressions, and insect wings. A single wing impression in one instance measured nearly four inches in length.

The next record in the walls of the Canyon, is about 400 feet of Coconino sandstone of Permian age. This formation is known as the best Permian fossil-track horizon in the world. At present twenty-five species of animal tracks have been described. This number will undoubtedly be doubled or even tripled when a complete collection has finally been made.

The top-most formation in the walls of the Canyon is the Kaibab limestone of Permian age. A great many species of marine fossils have been collected from this formation. It is difficult for the layman to visualize this plateau, some seven thousand feet above sea level on the south rim and about eight thousand three hundred feet above sea level on the north rim, as having been formed beneath the sea.

Geologists believe that sediments measuring nearly 6,000feet or over one mile in thickness once rested on top of the present top-most layer at the Grand Canyon. The complete succession of these younger formations may be seen in southern Utah at Bryce Canyon and Zion National Park. To a lesser extent some of the younger strata may be seen to the east at Cedar Mountain and to the south at Red Butte. Most of the younger sediments were removed by erosion from the immediate vicinity of the Grand Canyon before the great uplift occurred that resulted in the Colorado River removing enough material to expose to view "the world's most sublime spectacle."

Diagramatic profile of the Grand Canyon. (After Noble)