

GRAND CANYON Nature Notes

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M. R. Tillotson, Superintendent

Edwin D. McKee, Park Naturalist

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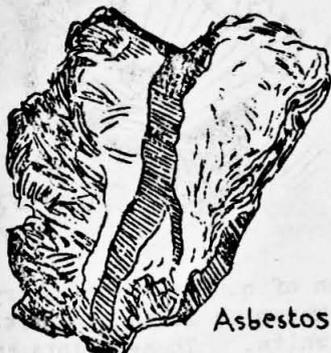


BLUE RIBBON MINERALS

By Ranger Naturalist H. H. Waesche.

ON June 22, 1931, some seventeen different specimens of minerals representative of the Grand Canyon were sent to the Northern Arizona State Fair at Prescott. These were on exhibit there during early July. The collection included both non-metallic and metallic minerals, but mostly the former. Because they are typical of the Grand Canyon and because they are of exceptional quality, a brief description of each is here given.

One rock specimen containing a vein of asbestos is especially worthy of mention. This asbestos is of a variety known as chrysotile. It forms a seam



Asbestos

that is small and variable, the individual fibers ranging in length between one-eighth and one half an inch. The associated rock in which the vein is found is a much metamorphosed limestone. The asbestos is of good quality, orange tan in color and had been commercially mined before the National Park was established. It is found in Grand Canyon

in the Bass Limestone of Algonkian Age. The particular specimen described was obtained at the Bass Camp, Hakatai Canyon.

A large specimen of Gypsum of the variety known as Satin Spar was included in the exhibit of minerals. It seemed to be fairly pure and was



Gypsum

white in color. Gypsum is commonly found in the Triassic red formations of semi-arid origin such as the Moencopi sandstone found near and around Grand Canyon.



Down in the Granite Gorge at the bottom of Grand Canyon many metamorphic minerals have been found. Some very beautiful specimens of garnets are to be seen there. They are sometimes associated with the black schists or, as in the case of a specimen included for exhibit, with a white quartzite. The garnets are a red variety, probably almandite. They are somewhat shattered crystals, dodecahedrons and trapezohedrons about three-quarters of an inch in diameter. They were found near Phantom Ranch.



the crystals were about one-quarter of an inch in diameter, but they reached a size of three-quarters of an inch at the outer end of the prism. Oscillatory combination striations were present both on the prism and the rhombohedral faces. Some garnet was associated with the quartz. The specimen came from the Algonkian beds on the west side of the river between Unkar and Chuar creeks.

Included in the collection were two different varieties of quartz taken from very distinct horizons. One was of a white crystalline variety composed of a series of irregular radiating crystals. The crystals were six-sided prisms capped by two rhombohedrons resulting in six-sided pyramids. At their bases



The second specimen of quartz was of a cryptocrystalline variety known as flint or chert. It was banded grey and white. These flints are common in the Kaibab limestone where purity is probably responsible for the white coloring. The gray bands are perhaps caused by carbonaceous matter.



There was also in the collection a characteristic specimen of red Feldspar of the variety Orthoclase. This fragment of a large crystal

had the usual right angled cleavage of orthoclase as well as the satin-like luster of most feldspars. The cleavage fragment was about three-quarters of an inch wide by three inches in length. Associated minerals were muscovite, biotite and some hornblende. This material was found in a granite dyke which had been intruded into the Vishnu schist of Archean age.



Mica is found in the Archean rocks of the Inner Gorge. Biotite is the more common form found here, occurring abundantly in the schist, but in some of the dykes of granite large flakes of the variety muscovite are obtained. Several specimens of the latter, grayish-green in color, were included. The thin cleavage pieces were colorless.

Calcite is a very common mineral all through the Canyon formations. Good crystals are found in the Redwall, Supai and Kaibab formations. One of the most beautiful specimens sent to Prescott consisted of several large crystals of calcite of a variety sometimes known as "dog-tooth spar". This variety is a crystal scalenohedron, one of the two forms into which calcite characteristically crystallizes.

The crystals are honey-colored, probably being stained from small amounts of vanadium. They are about three inches in length and grouped together, they were found in the Redwall limestone of the Bridal Veil Mine in Havasu Canyon.



Another specimen showing some very beautiful crystals of calcite consisted of a rounded piece of limestone completely covered with small reddish brown crystals. These small crystals also were scalenohedrons but were only about one-eighth of an inch in diameter. Apparently all of these specimens of calcite had crystallized from lime-bearing.

This series of minerals was awarded the blue ribbon indicating first prize for non-metallics at the State Fair.

Accompanying them, moreover, were several rather interesting specimens of metallic minerals. Among these was a very fine and nearly perfectly formed cube of Galena measuring about one and one-half inches across. Two samples of iron ore minerals, both hematite, were also included. One of these was a very fine grained specimen of specular hematite. The other was a large impure nodule of a red type. Both minerals came from rocks of Algonkian Age and were found near Chuar Creek. Copper ores were represented by a specimen of chalcopyrite and by one of malachite. The chalcopyrite formed a rich ore in a matrix of quartzite and was associated with pyrite and what appeared to be a small amount of bornite. The malachite was in the form of a large irregular and impure mass. The chalcopyrite was from rocks of Algonkian Age and was found at the site of the

Bass Copper mine. The other copper was from the Grand View mine in the Redwall.

Many other minerals are found in the series of formations forming the walls of Grand Canyon, but those mentioned include most of the commonest as well as the most interesting types.

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The BLUE HAZE OF GRAND CANYON

By Ranger Naturalist Ralph A. Redburn,
with suggestions and additions by
Prof. Henry Norris Russell, Princeton University.

"WHAT is that blue haze?" asks the tourist of the Ranger, as he looks at one of the most conspicuous features seen in the Grand Canyon.

This beautiful blue film is not due to any queer phenomena. It is natural that it should be here; it is present all over the world, although it is not as noticeable in some regions as in others.

August, 1931.

To explain this, one must speak primarily of two things; one, our blue atmosphere, and the other the reason why this haze is so conspicuous or so intensified in the Canyon.

The Atmosphere (Atro meaning vapor - Sphaira meaning sphere) is a film of gaseous elements which forms a continuous envelope around our earth. Two of the most important properties of our atmosphere are its composition and its color - color being the most obvious to the human eye. The atmosphere is composed of about seventy-seven percent nitrogen, twenty-three percent oxygen and about three one-hundredths percent carbon dioxide, with traces of many other elements. There are also present various amounts of impurities such as dust particles and water vapor. These dust particles come from many sources such as those rising from the earth under the influence of wind, those coming from volcanoes, from burning meteors, and from pollen grains and spores of plants.

The blue color of the atmosphere comes mainly from the air itself and is due to the scattering of light by the tiny molecules of which the atmospheric gases are composed.

Sunlight, as the spectrum shows, is composed of rays of different colors. The visible rays, when combined, give us white light. There are also many rays which our eyes do not see, such as the very short rays: the ultra-violets, and the very long rays: the infra-reds. The rays we see are those which give atmospheric colors. Of these there is a gradual gradation from the short rays to the long rays. The shortest visible rays are violets and blues; the longest are reds and yellows.

All material particles scatter a part of the sunlight which falls on them - as anyone can see in a dusty room. Particles which are larger than the length of the light waves scatter light of all colors to about the same extent so that a cloud of dust looks whitish as does also an ordinary cloud, which is composed of small drops of water suspended in the air.

But particles smaller than the light-waves get the best grip (so to speak) on the shortest waves, and scatter them much more powerfully than the longer waves. The molecules of the air behave in this way. If they did not scatter light the sky would be black, and we could see the stars at noon. As it is, they scatter far more blue light than red, so that the sky appears bright, but blue. Owing to the loss of these blue rays, the direct sunlight is yellower than it would be if there were no air above us. When the sun is low in the sky and its rays come through a great thickness of air, almost all the blue and violet light is taken out of the direct beam - to make blue sky for other places - so that the setting sun appears yellow, or even red.

In thickly settled districts there is usually a great deal of dust in the air which scatters light of all colors equally, so that the sky, even when cloudless, is but of a milky blue, and there is a great halo of whitish scattered light around the sun. With very dusty air the sky is grey, the visibility of distant objects poor, and the direct sunlight feeble. But

in the pure air of high altitudes the sky is a deep blue. Under the best conditions, it is blue light up to the sun's edge, as one can see by hiding the sun with the hand.

Measurements by Dr. Abbot of the Smithsonian Institution show that at such a time the light of the sky is practically all scattered by the air-molecules, so that the sky is as blue, and the air as clear, as it possibly can be.

The higher one gets, whether on a mountain, in an airplane or a balloon, the darker the blue of the sky becomes, simply because there is less air above to scatter the light. From aircraft at a great height, in clear weather, a blue veil appears to be drawn over the whole landscape beneath the blue light scattered by the air below the "ship".

This very beautiful phenomenon can be seen almost daily from the rim of the Grand Canyon.

The atmosphere naturally extends down into the very bottom of the Grand Canyon, and because of its blue color, blue haze becomes evident between the walls.

The reason this haze is so conspicuous here is due mainly to two features; the walls acting simultaneously as a background and reflecting agent, and to the atmosphere being rather pure and free of dust.

Looking across the Canyon to the opposite rim your vision is stopped by the wall against which the atmosphere stands out quite distinctly. This wall acts as a background. During the morning the blue haze appears a deeper color in the eastern end of the Canyon, than it does during the noon hours, while in the evening it is more conspicuous towards the west, this being due to the shadows of the walls and other features casting a darker background of reflection.

The blue haze is seen at its best when the Canyon is in full sunlight. When it is under clouds no direct sunlight falls on the air between the Canyon walls, and there is little to scatter.

The atmosphere in the Canyon where the elevation varies between two thousand five hundred and eight thousand feet, is more pure and free from dust than in many other parts of the country. The action of wind in the Canyon is so very slight that there is not a great chance for any increase in the number of dust particles.

During the infrequent windy periods here at the Canyon the haze becomes grey because of the increased number of dust particles in the atmosphere. But usually due to the clarity of the air and its correspondingly small number of dust particles, the scattering of the blue light rays is predominant. That is why we say --- "Out West the Sky is a Little Bluer."

SOME BIRDS AND THEIR NESTS ON THE KAIBAB

BETWEEN the dates of June 27 and July 9, 1931, Mr. Clifton M. Greenhalgh of Kanab, Utah, and I made a survey of the bird life of the Kaibab Plateau. Some 48 species of birds were observed and positively identified. Because of limited space these are simply listed in this brief report but the nesting records are given in some detail.

Mourning Dove
 Western Red-tailed Hawk
 Alpine Three-toed Woodpecker
 Mearns Woodpecker
 Red-shafted Flicker
 Western Wood Pewee
 Long Crested Jay
 Raven
 Clarke Nutcracker
 Western Evening Grosbeak
 Cassin Purple Finch
 Green-backed Goldfinch
 Pine Siskin
 Western Robin
 Mountain Bluebird

Western Lark Sparrow
 Western Chipping Sparrow
 Western Tanager
 Western Warbling Vireo
 Audubon Warbler
 Grace Warbler
 Western House Wren
 Rocky Mountain Nuthatch
 Pigmy Nuthatch
 Gray Titmouse
 Mountain Chickadee
 Ashy Ruby-crowned Kinglet
 Audubon Hermit Thrush
 Chestnut-backed Bluebird

(List continued on Page 105)

Nest Records

Alpine Three-toed Woodpecker - One male was seen at V. T. Lake June 28, 1931. A nest was found June 30 in Dog Canyon near the East Rim. I had to hunt about an hour before I discovered it. Meanwhile the female bird kept up a continuous chattering and fluttering from a distance to try to attract me away. Later both parents fed the young in the nest. The old birds were very nervous and would not come near while we were close. The nest contained two young about ready to fly, a male and a female. The male had a distinct orange crown - that of the female was less distinct. I banded both young and photographed them in a natural position near the



Alpine
Three-Toed
Woodpecker

nest which was in a hole in an aspen, about twelve feet above the ground. The diameter of its opening was $2\frac{1}{2}$ inches. On the bottom was a thick layer of sawdust chips about 8 inches down from the hole. All through the chips were many small white maggots which did not seem to bother the young birds. The following day I returned to find the parents still feeding the young.

I found another nest in a hole about sixty feet above the ground in a yellow pine at Cougar Lake July 2. The female was feeding young in the nest.

On July 3 one male was seen at Lookout Lake.

Red-shafted Flicker - Common on the Kaibab during our stay. More numerous on the higher portions. A nest was found about twenty-five feet above the ground in a hole in an aspen at V. T. Lake. It contained young about ready to fly. -- June 30, 1931. Another nest was found by Mr. Rasmussen, Forest Ranger, in a similar hole in an aspen at Dry Park.

Western Chipping Sparrow - Numerous all over the Kaibab during our stay, seen mostly along edges of parks and near springs and lakes. A nest containing three young was found in a spruce about fifteen feet above the ground at the V. T. Ranger Station. It was built on the end of a branch. We watched both parents feed moths and grasshoppers to the young.

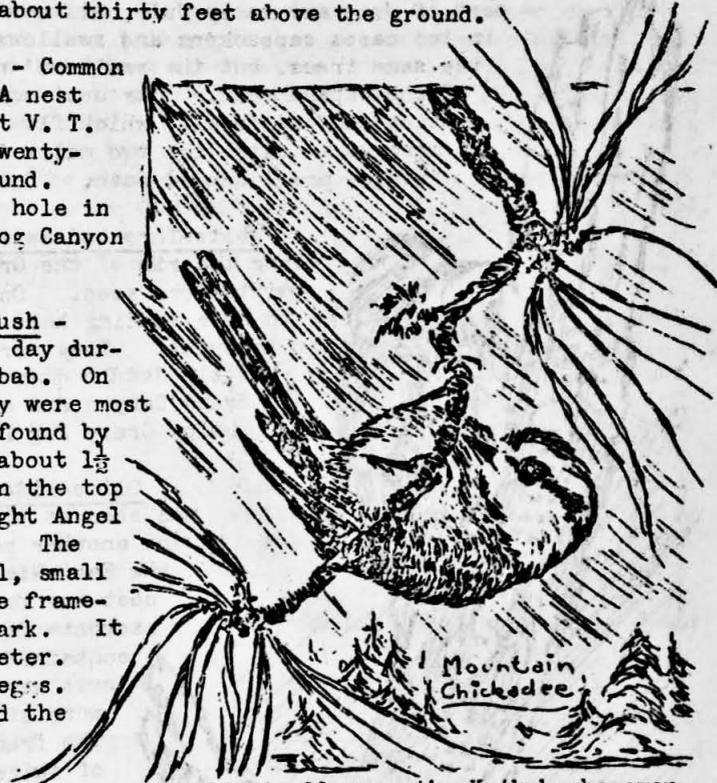
Audubon Warblers - Apparently a common summer resident on the Kaibab everywhere. A nest was found about twenty feet above the ground in a yellow pine. It was two feet from the trunk made in a crotch of four small branches. It was one and one-half inches in diameter and one inch deep, made of grasses lined with small blue, brown and green feathers and fine grasses. It contained four young in the fuzzy stage, their eyes not yet open. Both parents fed the young. July 4, 1931.

Western House Wren - Seen almost every day during our stay on the Kaibab, near lakes and springs, especially in the higher portions. A pair was found nesting at Castle Spring. They were carrying food to the young. July 3, 1931.

Rocky Mountain Nuthatch - Several were seen every day during our stay on the Kaibab. They appeared to be more numerous on the higher portions. In an aspen near V. T. Lake a female was seen feeding young, June 30, 1931. The nest was in a hole about thirty feet above the ground.

Mountain Chickadee - Common all over the Kaibab. A nest was found in an aspen at V. T. Ranch in a hole about twenty-five feet above the ground. Another nest, also in a hole in an aspen was found in Dog Canyon near the East Rim.

Audubon Hermit Thrush - Several were seen every day during our stay on the Kaibab. On the higher portions they were most numerous. A nest was found by Park Ranger R. E. Laws about 1½ feet above the ground in the top of a little spruce, Bright Angel Spring - June 29, 1931. The nest was lined with wool, small grass, and string. The framework was of twigs and bark. It was four inches in diameter. It contained four blue eggs. Ranger Laws photographed the mother on the nest.



Western Robin - Common summer resident all over the Kaibab wherever there are open parks and water. Several nests were found; some in spruce, others in aspen.

Mountain Bluebird - Seen every day during our stay on the higher portions of the Kaibab. Some records from the middle portions. Several pairs nested at the V. T. Ranch and at Bright Angel Point.

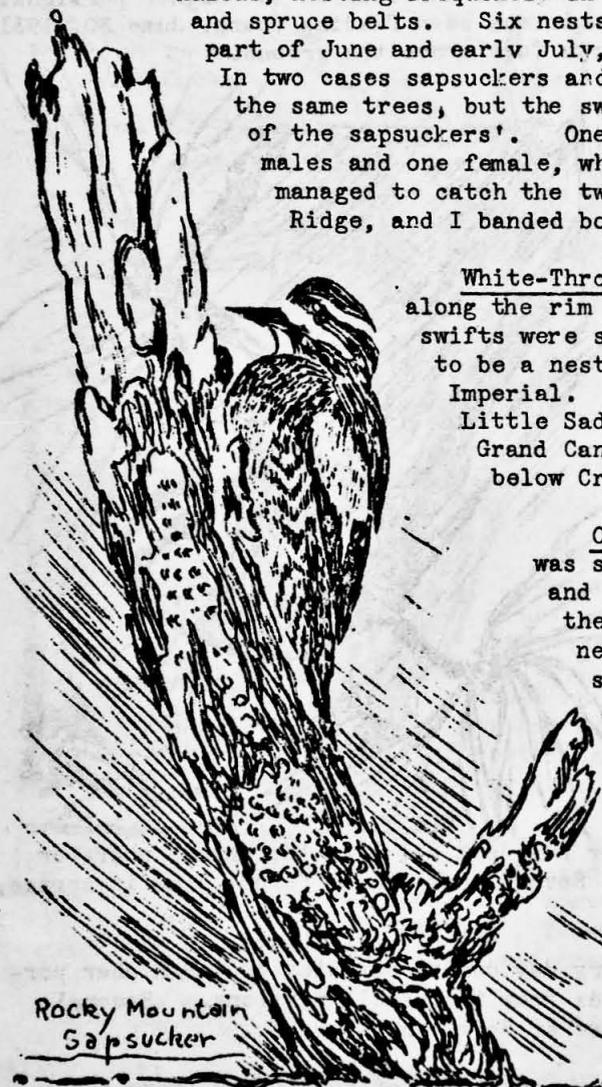
Red Backed Junco - Common summer resident of the Kaibab, more numerous on the higher portions than on the lower. A nest was found at Bright Angel Point containing four eggs. It was made on the ground in a tuft of grass; the framework of larger grasses lined with smaller ones and with horse-hair. -- June 29, 1931. A few days later the nest was washed away by a hail storm.

Northern Violet-Green Swallow - A fairly common summer resident of the Kaibab. Many nests were found during the last days of June and early July in holes in Aspens ranging from ten to sixty feet above the ground. Sapsuckers' nests were found in holes in some of the same aspens but below the swallows' nest holes. Several of the latter were seen in the Grand Canyon just below the North Rim near Little Saddle, July 6, 1931.

Rocky Mountain Sapsucker - A fairly common resident of the Kaibab, nesting frequently in aspens throughout the pine, fir and spruce belts. Six nests were found during the latter part of June and early July, all containing young birds. In two cases sapsuckers and swallows were found nesting in the same trees, but the swallows' nests were above those of the sapsuckers'. One nest contained three young, two males and one female, which flew when we approached. We managed to catch the two males in a valley near Lookout Ridge, and I banded both. July 4, 1931.

White-Throated Swift - Wherever we stopped along the rim of the Grand Canyon many of these swifts were seen. One flew into what appeared to be a nesting hole under the cliff at Point Imperial. They were fairly numerous from Little Saddle down to the bottom of the Grand Canyon and at Thunder River; also below Crazy Jug Point.

Olive-sided Flycatcher - A pair was seen at the V. T. Ranger Station and another pair in Dog Canyon near the East Rim, June 29 and 30. A nest was found on July 1 about seventy feet up in a spruce. It contained three young, whose eyes were not opened, and who were still in the fuzzy stage. The framework of the nest was of twigs and yellow pine needles. It was lined with grasses and roots, built on top of a branch about two and one-half feet from the trunk of the tree. It was $2\frac{1}{2}$ inches in diameter and 1 inch deep. The parents were quite vicious and darted at me as I photographed the young in the nest.



Since the latter was near the top of the tree, about seventy feet up, it was necessary for me to use a climbing belt. We found another nest near the V. T. Ranger Station the afternoon of the same day. It contained two eggs. One other had been broken in the nest previously. The eggs were

lilac in ground color; one slightly darker than the other. Both had dark and light brown spots near the larger end. This nest was practically the same as the other, except that it was lined with green lichens and roots. It was five feet from the trunk, about forty feet up in a spruce and was placed on top of a branch. The pair which had occupied this nest were observed in the same vicinity until we left the Kaibab.

Another Olive-sided Flycatcher was seen at Bee Spring, July 6, 1931.

Goshawk - On July 2, 1931, Mr. Rasmussen, Forest Ranger, showed us a nest about forty-five feet above the ground built as a platform on four branches next to the trunk of a yellow pine. It was about eight inches thick, nearly one and one-half feet in diameter, and flat on top. It was made of large sticks, lined with fresh green fir twigs. It contained two young hawks almost ready to fly. Both parents were quite shy but kept squawking. The nest was near the observation tree in Road Hollow. I photographed the young in the nest but did not have bands large enough to band them. Mr. Rasmussen saw a goshawk again at V. T. Park, July 5, 1931.

(List continued from Page 101)

Red Backed Junco	Rocky Mountain Hairy Woodpecker
Western Horned Owl	Broad-tailed Hummingbird
Northern Violet-green Swallow	White-throated Swift
Rocky Mountain Sapsucker	Canyon Wren
Killdeer	Olive-sided Flycatcher
Dusky Grouse	Goshawk
Cooper Hawk	Band-tailed Pigeon
Sparrow Hawk	Spotted Sandpiper
Rock Wren	Townsend Solitaire
Rocky Mountain Black-headed Grosbeak.	

On a side trip into Thunder River the following birds were seen:

Spurred Towhee	Band-tailed Pigeon
Nighthawk (Western ?)	Canyon Wren
Desert Black-throated Sparrow	White-throated Swift
Desert Song Sparrow	Western Mockingbird
Sage Thrasher	Green-backed Goldfinch
Water Ouzel	House Finch
Rock Wren	Turkey Vulture
Cassin Vireo	Broad Tailed Hummingbird
Lead-colored Bushtit	Northern Violet-green Swallow

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A yellow lily (*Eremocrinum albomarginatum*) was found on the South Rim of Grand Canyon for the first time on July 15. It was growing on a rocky shaded ridge east of the village. This lily has a narrow range. Tiedstrom states that it is confined to Utah yet this record extends its range into Arizona.

-- - Pauline Mead Patraw, Botanist.

TREES GRIPPING THE HILLSIDE

By Ranger Naturalist
E. W. Count



the vital role played by trees in preventing landslides and avalanches; and, where the slope is especially steep, as on Bright Angel Point, the traveler can well stop and ponder the justification of the ancient Swiss law which, it is said, made the cutting of a tree on a landslide slope a capital offense.

One lordly Douglas fir on Bright Angel Point bears many a scar of the eternal battle of life. Its base is curved, as described; but the tree, instead of growing vertically thereafter, leans back and twists around and up like a man avoiding a blow on the head. The lower branches are largely confined to one side of the tree. A rotting stump fitting against the base tells the rest of the story: this tree not only battled the slide of the loose soil, but had to compete with an older trunk for a place in the sun. It leaned outward from among the foliage of the older tree, and thus grew crooked. Today the older tree is gone; but the habits of the now stately younger tree cannot change; as grew the sapling so is the tree.

TO the North Rim visitor, the curved shape of the lower trunks of trees, notably aspens, often presents a puzzle. On the steep slopes along Bright Angel Point, many a Douglas fir shows this same peculiarity. The winter snows are so heavy among the trees here, that sometimes the young ones are pressed downward almost into a horizontal position. The supporting earth, meanwhile, is soon soaked with water, and the soil starts to "creep" downhill. Next season the tree starts its new yearly growth from the tip of last year's; at that spot it again points its top skyward. With young and tender seedlings this crushing hand of inert nature is especially severe. Only the vigorous, swiftly-growing trees are able to gain such a lead as to push their roots into the soil and grip it more deeply than the soil can creep, eventually arresting this slipping of the earth, and thereafter growing straight again. Furthermore, as the trunk becomes thicker, the limp weight of the snows can no longer bend it. This is a graphic lesson of

GRAND CANYON

By Edwin D. McKee,
Park Naturalist.

A Barrier to Reptiles ?

MUCH has been said concerning the effectiveness of the Grand Canyon as a barrier to the migration of mammals - notably to the tassel-eared squirrels, a species of which is found on each rim. Several prominent zoologists, furthermore, have suggested that the development of distinct species from a common ancestor has been brought about by isolation thru the cutting of Grand Canyon. Of such importance biologically is this problem that the Naturalist staff of the Park has made a special effort to obtain more knowledge of the subject by studying the effects of the Canyon on other types of life as well as mammal.

It should be stated here at the start that our present knowledge of the flora and fauna, and especially of the flowers and reptiles, is so limited that until we know more concerning the ranges of individual species we must accept with caution the conclusions given in this article. So interesting, however, is some of the material at hand that I feel justified in making preliminary statements which are as accurate as present knowledge permits.

It seems fairly safe to say, and altogether reasonable, that the birds of this region are little or none affected by the Grand Canyon as a barrier. Obviously where the normal life zone of a species is found on both sides of the Canyon, individuals can and do, under ordinary circumstances, fly to one locality as readily as to another. It is true that certain species, as the Dusky Grouse, have been recorded only from the North Rim; however, this is explained by the higher altitude represented there rather than by any isolating influences of the Canyon since similar species are also found in the Canadian Zone of the San Francisco Mountains to the south.



Coral King
Snake

Concerning the flora it seems probable that we have a situation analogous to that of the birds. Certainly the range of plants in Grand Canyon as elsewhere is controlled to a fine degree by the temperature and therefore by the altitude, but the gorge itself is probably no barrier to the spreading of plants as a whole. The careful and detailed work of Mrs. P. M. Patraw, botanist, over a period of several years seems to check this in general, though further investigation of the status of several important plant groups is necessary before any very positive statement can be made.

The reptiles of the Northern Arizona plateau, as well as the small mammals, seem to be very definitely restricted in range by the Grand Canyon. Contrary to common opinion, however, it does not appear to be the steepness of canyon walls, the depth, or the Colorado River itself which are the barriers, but rather the fact that the hot Lower Sonoran Zone with its peculiar desert vegetation lies between the more temperate zones of the Rims. Our records show that in every case, those reptiles which are native to the Canyon interior are found in about equal abundance on both sides of the river. On the other hand, of those reptiles which are restricted to the Canyon rims we find with only one exception (garter snake, *Thamnophis ordinoides vagrans*) the same genera but distinct species on each side.

UPPER CANYON SPECIES

North Rim only	Both Rims	South Rim only
Utah Gopher Snake <i>Pituophis catenifer</i> <i>stejnegeri</i>	Striped Swift * <i>Sceloporus c. conso-</i> <i>brinus</i>	Arizona Gopher Snake <i>Pituophis catenifer</i> <i>rutilus</i>
Great Basin Rattler <i>Crotalus c. lutosus</i>	Painted Desert Swift * <i>Sceloporus elongatus</i>	Prairie Rattlesnake <i>Crotalus c. confluentus</i>
Coral King Snake <i>Lampropeltis pyromelana</i>	Sagebrush Swift * <i>Sceloporus g. graciosus</i>	Brown spotted Garter Snake <i>Thamnophis angustirostris</i>
Tree Uta Lizard <i>Uta levis</i>	Wandering Garter Snake <i>Thamnophis c. vagrans</i>	White bellied Garter Snake <i>Thamnophis eques</i> .
Short-horned Horned Toad <i>Phrynosoma d. ornatissimum</i> ?		Short-horned Horned Toad <i>Phrynosoma d. hernandesi</i> ?

NOTE: It is not yet definitely known whether the two Horned Toads are distinct subspecies as listed by some herpetologists, or not. There is a difference of opinion here.

* Records from Canyon bottom also -

From a survey of the foregoing statements one might wonder at first why it is still deemed necessary to question whether the Canyon is a barrier to reptiles. The example of the gopher snake especially seems convincing of this theory. In refutation, however, may be pointed out the examples of some southern California species which are found at high altitudes in several isolated desert ranges, but which are unknown in the hot regions between. Notable examples are the Rubber Boa (*Charina bottae*) - not found below the Transition Zone - and the little Fence Lizard (*Sceloporus g. vandenburianus*). A parallel case and one with more direct application is that of the Coral King Snake, a species of which is found at the high altitudes of the North Rim and also near the summits of numerous lofty mountain ranges in southern Arizona. Is it then that reptiles which have been isolated from their kin are slower to develop new and distinct characteristics than are small mammals under similar conditions? Or are the reptiles more capable to find passageways across the hot desert areas to the cooler climates of their liking beyond? Again, must we concede that such excellent cases of the Grand Canyon acting as a barrier as that presented by the Gopher Snakes are really nothing more than the accidental range division between two species? All these are interesting and important biological questions and only a continued and careful study will reveal the true answers.

