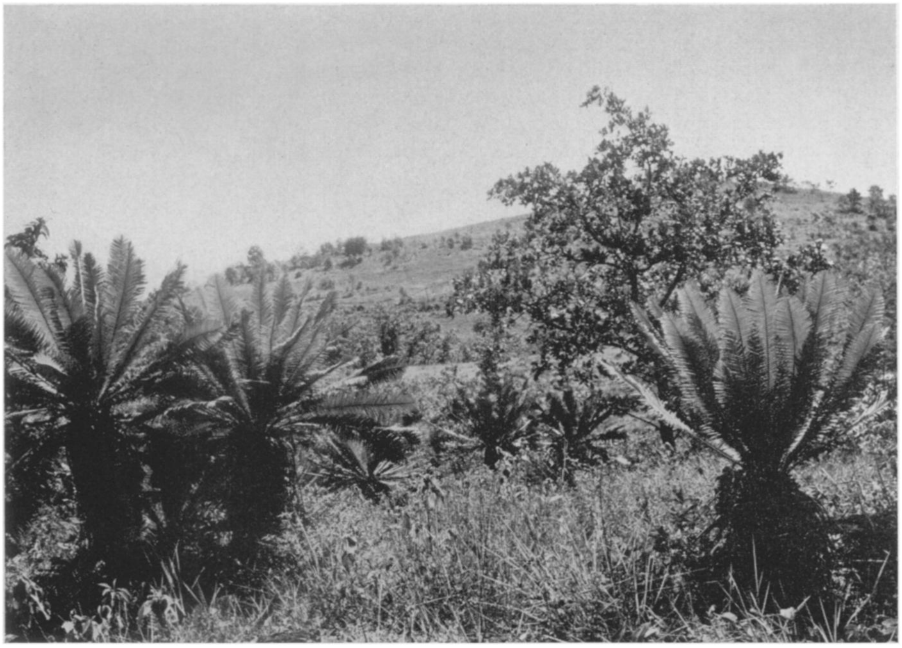

IN MEXICO
Cycads mingle with oaks on dry hillsides.

PALEOBOTANY

Living Forests Are Clue To Climate in Ancient Times

Horsetails, Tree Ferns and Cycads Similar to Those Growing in America's Past Show What Conditions Were

FOSSIL plants serve as thermometers and rain gauges of the ancient days of the earth.

Their earliest appearances, their migrations, the changes in their stems and leaves, their extinction in different localities, all reflect the responses of organisms sensitive to change in an ever-changing world.

During trends to warmer and wetter climates, leaves increase in thickness and stems attain greater width and girth; while during the slow swings toward frigidity and drought, trunks and foliage are reduced.

Utilizing these principles, Dr. Ralph Chaney of the University of California, research associate of the Carnegie Institution of Washington, has been able to reconstruct the climatic story of parts of the Pacific coast of the United States. In the forests of Guatemala he has found many trees similar to those which grew in Oregon and parts of California 200,000,000, 150,000,000 and 60,000,000 years ago. They show approximately the conditions of temperature and rainfall which must have obtained hundreds of miles to the northward during those periods.

The Guatemalan trees, of course, are not identical with those of ancient North America. They belong to different genera or species. Some of their requirements may have changed. But they provide a basis for a general picture of the great changes which have taken place. Even the fauna of these Central American forests is not vastly different from that of earlier periods in the history of Oregon, all of whose animal life of those days is long since extinct.

It seems, at times, almost like an excursion backwards through time into the age of the dinosaurs when one visits the Guatemalan wildernesses.

Remains of the most ancient forest known to have lived in western North America have recently been found in the Blue Mountains of Oregon.

It covered the shores of an embayment which extended inland for several hundred miles across what is now the Cascade Mountain range. The extent of this seaway is indicated by remains of marine shells representing animals known to have lived widely over the world during the Paleozoic era, when life first became abundant on the planet.

This was the Carboniferous period, more than 200,000,000 years ago. During this time accumulations of stems and leaves in the great swamps of eastern North America were providing carbon for the rich coal deposits. Similarly, leaves and stems of the great Oregon forest were buried in sand and preserved as fossils.

It was a strange forest. Among the most common of the remains which have been preserved are tall rushes with jointed stems related to modern horsetails. They are known as calamites. Fernlike plants unlike any now living were part of this ancient forest.

Horsetails today seldom are more than a few feet high. Their stems are slender. Calamites had trunks up to 75 feet tall and a foot in diameter. Ferns with fronds several feet long are now common in humid forests bordering the Pacific, but their stature is low because their stems are almost entirely underground. The ancient Oregon ferns were fairly large trees. Nowhere in the United States today is there a living woodland even remotely like the Paleozoic forest of the Blue Mountains.

But in Guatemalan valleys which lie in the zone of daily fogs, too high to be considered strictly tropical but never touched by frost or drought are tree ferns in abundance. They mingle on the valley slopes with such relatively modern trees as evergreen oaks, red gums and laurels. They average 15 feet in height and may be twice that tall. Their radiating fronds are evidence of the rich verdure of the ancient Oregon forests, even though the fern fossils are only grey impressions on the sandstone. The ancient fronds differ from those of modern tree ferns in bearing seeds rather than spores. Otherwise they are wholly similar, indicating remarkable conservatism of leaf forms through vast ages.

Bordering the Guatemalan streams grow thickets of horsetails whose stems rise to a height of nearly 15 feet. No longer reinforced by woody tissue as were the great trunks of the calamites, these giant Equisetums grow more erect than their smaller relatives of the temperate zone. In places they are so abundant that they seem to cast a shadow of the past down the ages. Even here, the forest giants of the past are reduced in size and subordinated in numbers by more modern trees.

A third type of plant characteristic of the Carboniferous, the club moss, also is represented in the Guatemalan valleys although less conspicuously, being dwarfed from a giant tree to a creeping vine.

In nearby swamps live distant relatives of the large salamanders which were the most abundant land animals of the Age of Ferns. Small as tree toads, their voices are stentorian. All night long they croak and boom so loudly that a visitor after dark might imagine that giant amphibians still splash among the ferns and horsetails, as did their ancestors in the darkness of 200,000,000 years ago.

Fifty million years later the great horsetails and seed ferns largely had disappeared. They were succeeded by the cycads, a name arising from the position of their leaves in cycles at the end of the stem. These were palm-like in general appearance.

Well preserved leaves of these cycads recently have been discovered at the Petrified National Forest Monument in Arizona. Stems, so completely turned to stone that every detail of woody structure is preserved, have been found in the Black Hills of South Dakota.

They have completely disappeared in these regions, but today whole forests of them cover the slopes of dry valleys in the state of Vera Cruz on the Atlantic slope of Mexico. Their trunks rise to a maximum height of six feet and a diameter of 14 inches. The dark green leaves are nearly three feet in length and the tips are so stiff and sharp that they sometimes cause painful scratches.

Ferns grow near them as they did during Mesozoic time and rivers not far away are the homes of crocodiles, the largest survivors of the age of reptiles. Standing on one of these hillsides we may look out on a landscape whose vegetation and saurian inhabitants are not very different from those of the Mesozoic era.

The last 60,000,000 years of earth history, the Cenozoic era, have been characterized by forests in which flowering plants predominate. The trees which lived in western North America at the start of this era bore large, thick leaves. Many fossils of them have been found in California and Oregon.

There they have completely disappeared. To find living trees with similar leaves we must go southward to the rain forests of Guatemala and Mexico, and the fog-wrapped slopes above them. Many denizens of the temperate rain forest are quite similar to those of the Cenozoic trees of the West. During that time there must have been abundant rainfall both summer and winter along the Pacific Coast. Today the dry summer makes it difficult or impossible for such trees to live in western North America. The climate must have changed greatly since the days of the ancient forest.

All the animals of these Cenozoic forests have long since become extinct. None are even closely related to living mammals. But the occurrence of primitive primates shows an element corresponding to the monkeys now common in the rain forests of Central America. Animals related to the rhinoceros have a modern equivalent in the tapir of tropical America. Even the large guinea pigs so characteristic of the rain forests of Guatemala have a prototype in a Cenozoic rodent recently discovered by Dr. Chester Stock, Carnegie Institution paleontologist. This is about as close a resemblance as could be expected after so many million years.

The Cenozoic floras of western North America, as revealed by the fossil record, were very similar across regions which now have very different types of forests. The same kinds of fossils are found on both sides of the Cascade mountains. Today most of the rainfall is concentrated on the western slopes of this range, and the area to the east is suited for trees only in the valleys and on higher slopes. Most of the John Day basin is occupied by sage brush and junipers, where once was a rain forest extending eastward from the shores of the Pacific.

We may conclude from this, says Dr. Chaney, that in early Cenozoic time the Cascade range had not yet been raised to form a barrier to rain-bearing winds from the sea. Thus it is possible to date a major episode in mountain building from an analysis of the vegetation of past ages.

Even with these mountains lowered to the level of a coastal plain, the forests of Oregon today would not be like those of Guatemala. The winters are so cold that the more delicate plants cannot live so far north. The summers bring drought which has driven a large number of the trees of the past from this northern outpost of their empire.

The causes of this climatic change are little understood. In part they seem to be due to altered distribution of sea and land and to the uplift of mountain ranges, resulting in restricted circulation of air and of water. Since winds and ocean currents profoundly affect the climates of today, it is reasonable to assume that changes in their circulation may have affected profoundly the climates of yesterday.

Another cause of climatic change is variation in the amount of energy received from the sun. This has changed slightly during the short time the sun has been under scientific observation. It may well be that it has fluctuated from age to age, with resultant changes in the temperature of the earth and changes in the character of forests, as recorded by the fossils.

One other aspect of modern Guatemala gives us some insight into the environments of the forests of the past in the western United States. In a belt extending across Guatemala, volcanoes rear their cone-shaped peaks high into the clouds. One of them, Volcan Santa Maria, has poured out lava flows in this century and vast quantities of ash have been blown from its crater with explosive violence. After several decades this grey ash still mantles the cornfields.

Similar dramatic events in history may be recognized when we examine Oregon rocks in which the forests of the past have been preserved as fossils. In Guatemala we see scores of feet of volcanic ash and lava accumulated only yesterday. In Oregon similar deposits, with the ash compacted into solid rock, mantle wide areas. They are exposed in the great valley of the Columbia and its tributaries, the John Day and Deschutes rivers.

These beds date from the early Cenozoic. Buried in them are leaves and trunks of trees which give a picture of forests growing on the slopes of ancient volcanoes, even as they do today on the slopes of the volcanoes of Guatemala. Perhaps leaves and branches are being buried there, to tell the story of our present world to paleobotanists of a distant future.

Thus the present runs forward into the future and merges backward into the past. Guatemala of today, its rain forests covering the slopes of active volcanoes, gives us a picture of Oregon's past. The semi-arid plateau of Oregon, reflecting changes in climate and land form down the ages, shows the measure of change which may take place in the Guatemala of some far-off tomorrow.

Science News Letter, February 1, 1941

CLUES TO THE PAST

These giant horsetails, now growing in Guatemalan forests, are similar in appearance to those of the Oregon forests 200,000,000 years ago.

MEDICINE

Neutron Rays Harnessed By Dyes for Cancer Attack

A MORE powerful attack on cancer than is possible with present methods of treatment may come from harnessing fast neutron rays with dyes containing lithium or boron, Dr. Paul A. Zahl, of Memorial Hospital, and Dr. Franklin S. Cooper, of the Haskins Laboratories, found in experiments. (*Science,* Jan. 17)

Mice were the patients in the studies of this method of using neutron rays to treat cancer. The dyes containing lithium or the boron were injected first. The dyes, when injected into the blood, accumulate in cancer tissue in greater concentrations than in normal tissue, and the lithium they contain, like boron, captures the neutron rays and concentrates their cancer-killing action on the tumors. At the same time the normal tissues are spared from the destructive effect of the rays.

A maximum gain of 43% in ray dosage of the tumor over that of other tissues in the same mouse was achieved, the New York scientists report. This could be increased further, it is stated, if lithium or boron isotopes were available in pure form.

Science News Letter, February 1, 1941

ASTRONOMY

Plenty of "Lebensraum" in Other Parts of Universe

In a Galaxy With 150,000,000,000 Stars There Must Be a Large Number of Planetary Systems for Life

PLENTY of living space exists in the universe elsewhere than on earth, and the chances are that life exists there. This is the conclusion of Laurence J. Lafleur, of Brooklyn College, stated in the current leaflet of the Astronomical Society of the Pacific.

Writing on what he calls "astrobiology," Mr. Lafleur states as a possible solution to the problem "the assumption that life comes only from life and never arises either by evolution or emergence from the inanimate, or by special creation. This philosophy avoids the difficulties of origin, and it is possible to assume either that life existed eternally in the past along with an eternal physical universe, or that both had an origin, possibly by divine creation, at some specific era of past time. In any case, the doctrine of Pan-Vitalism implies that life on earth must have arrived here from some other region, possibly on meteorites from another life-bearing planet.

"The whole universe may thus be filled with seeds of life which settle now and then on planetary bodies and grow into life on these planets where conditions are favorable. Conditions in the universe would then be analogous to conditions on earth, where any particular area may for the moment support no vegetation, but where each area is constantly seeded by the wind, and, when conditions become favorable, burgeons with life and becomes in its turn a source of insemination for neighboring land."

Adaptability of life is such that, even under widely different conditions from those which prevail on earth, it might be possible, believes Mr. Lafleur.

"In another world," he says, "a different quantitative distribution of chemicals might leave life possible even to organisms based on the carbon-oxygen-nitrogen-hydrogen compounds with which we are familiar. If nitrogen were rare instead of common and the other elements proportionately commoner, we might very well have organisms that obtain all other elements by a simple process of breathing or absorbing them from the environment, but which are especially adapted to the pursuit of nitrogen. Or, if oxygen were the rare element we might have organisms that breathe methane and nitrogen, and seek and eat silicates to obtain the oxygen content."

Even if the process of formation of planetary system is very rare, he states, "in a galaxy containing approximately one hundred and fifty thousand million stars, there must be at the lowest estimate a very large number of planetary systems, and in a universe containing many galaxies, a correspondingly greater number."

Philosophical considerations, he suggests, make the possibility of extra-terrestrial life quite likely. With this, in addition to the slight observational evidence, such as the observations which indicate the presence of vegetation on Mars, he writes, "we may conclude, with a fair degree of assurance, that life in the universe is not confined to our planet."

Science News Letter, February 1, 1941

TREE FERNS

These great plants are growing in the rain forest of western Guatemala.