THE MINNESOTA GEOLOGIST

OFFICIAL BULLETIN OF THE GEOLOGICAL SOCIETY OF MINNESOTA

VOL. XIII 1957 FALL - WINTER 1958 NO. 2

What scenery comes into view in any given place at any given time depends upon the underlying rock and the kind of geologic agent acting upon it.

Richard M. Pearl.

GEOLOGICAL SOCIETY OF MINNESOTA

EDITORIAL STAFF

Loretta E. & Elmer Koppen — Editors
3376 Brunswick Ave., Minneapolis 16, Minn.

STAFF ASSISTANTS

Mr. & Mrs. J. O. Engen
Hazen T. Perry
Mr. & Mrs. Chas. B. Howard
Dr. & Mrs. Bert Carlson
Mr. & Mrs. J. Merle Harris

OFFICERS

Hal E. McWethy, President
Charles H. Havill, Vice-President
Dr. Bert Carlson, Secretary
Ara P. Rickmire, Treasurer
Loretta E. Koppen Director
Clark Pettingill, Director
Margaret Paschke, Director
Charles B. Howard, Director

FOUNDER

Edward P. Burch *

PAST PRESIDENTS

Junior F. Hayden *
Alger R. Syme *
Charles H. Preston *
Joseph W. Zalusky
Dr. Edward H. Mandell
Hal E. McWethy
J. Merle Harris
Dr. Bert R. Carlson
Lawrence W. King

MEETINGS: October to May inclusive, 7:30 P.M. every 2nd and 4th Monday not a holiday, at Ford Hall, University of Minnesota, 17th Ave. S. E. and Washington Avenue. Visitors welcome.

FIELD TRIPS: May until October inclusive.

ANNUAL DUES: Residents in a 50 mile radius of the Twin Cities $ 3.00 plus $ 1.00 additional for husband, wife, or dependent family members. For students and non-residents, $ 1.00.

AFFILIATE MEMBER

MIDWEST FEDERATION OF MINERALOGICAL AND GEOLOGICAL SOCIETIES

and

THE AMERICAN FEDERATION OF MINERALOGICAL SOCIETIES

* Deceased

NOTES ON OUR WINTER ACTIVITIES

by President McWethy

Winter Lecture Series by Dr. J. Campbell Craddock, Department of Geology, University of Minnesota. The first of Dr. Craddock's lectures on structural geology will be given at Ford Hall, Room 55, at 7:30 P.M. on Monday evening, October 14, 1957. His lecture series will be held throughout the winter and spring on the second and fourth Mondays of each month until April 1958. It is highly important to all of us, both present and prospective members, that we attend this initial meeting with Dr. Craddock. We, on our part, will wish to demonstrate to him that we have a live, growing organization and that, also, we, as individuals, are anxious to learn more about our earth's surface structures and how they got that way. In this first lecture, he will outline briefly for us the scope of the subject which he will cover in this and the 11 succeeding lectures. Please come to this lecture and urge your friends to come also.

Dr. Craddock has a rich background of training and experience. He was born in Chicago in 1930, attended grade and high schools in Chicago and suburbs; secured a B.A. degree from De Paul University, Indiana, 1951; and M.A. degree and his Ph. D. degree from Columbia University in 1953 and 1954 respectively. During the summer of 1952-1953 he was field geologist for the New York State Museum and during the years 1954-1955 and 56, he was geologist for the Shell Oil Co. with locations at stations in Wyoming, Texas and New Mexico. He has been doing geological work in New Mexico this summer. His responsibilities at the University here include courses in Physical Geology, Structural Geology and a Black Hills Field Course.

There you have some of the highlights in the training and experience of the man who will deliver our lecture series on structural geology. Moreover, he has a charming personality and in his presentation of the subject, he will make every effort not to be so technical that he will be "shooting over our heads."

Mr. & Mrs. Lawrence King to Help the Beginners. As outlined to you in our last bulletin, Mr. & Mrs. King have consented to conduct a special preliminary discussion of geology for beginners beginning at 7:00 P.M. on October 28th, which is the second of our meetings with Dr. Craddock. You will hear more of our plans for this course on Monday evening, October 14, at Dr. Craddocks first lecture. We thought it advisable to give this entire first evening to Dr. Craddock and start the lectures for beginners on the second meeting. We are fortunate that Mr. & Mrs. King have consented to conduct this course which we feel sure will be of particular value to those who are starting geology as a vocational interest.

Mr. & Mrs. Kinghave returned from their trip to Wyoming to scout our next year's field trip to the Wyoming-Jackson Hole area. We should all be keeping this long field trip in mind for our vacation next June.

Moving of the Burch Rock Collection. For the past several years our Past-President, Joseph Zalusky has been kind enough to devote a portion of a basement room of the building housing the collections of the Hennepin County Historical Society to the use of our Society for a part of the collection of rocks and minerals gathered by Edward P. Burch over a ten-year period. With the moving of the Historical Society's collection from its location on Harmon

Place to 23rd Street and Park Avenue, it became imperative that we seek some other location for this collection. Fortunately, the garage of Mrs. Helene Becker at 2006 Dayton Avenue, St. Paul, is vacant and we were able to transfer the entire collection to that location. Mrs. Mary A. Myott has acted as the chairman of the committee having this activity in charge. We are hopeful that we may be able to use a portion of this collection in the winter's activities, as there are quite a large number of very good specimens in the collection.

PICTURES OF COLORADO-NEW MEXICO TRIP TO BE SHOWN ON NOVEMBER 4th. Kodachrome slides of the June 1957 "Long Trip" will be shown in our regular meeting place, Room 55, Ford Hall, U. of M. on Monday evening, Nov. 4 at 7:30 P.M. 150 of the best of the Kodachromes snapped by some of the members on the trip will be shown and explained by Miss Grace Benz and Mr. J. O. Engen. Everyone is urged to attend this special meeting.

BULLETIN-BOARD

TOPICAL OUTLINE OF LECTURE SERIES

TO BE GIVEN BY DR. J. CAMPBELL CRADDOCK

1. Oct. 14 Outline and development of Structural Geology.
2. Oct. 28 Primary structures.
3. Nov. 11 Folds and their origin.
4. Nov. 25 Normal faults.
5. Dec. 9 Transcurrent faults.
6. Jan. 13 Thrust faults.
7. Jan. 27 Salt structures.
8. Feb. 10 Volcanoes.
9. Feb. 24 Granite, its origin and significance.
10. Mar. 10 Continental drift.
11. Mar. 24 Structure and development of continents.
12. Apr. ~~14~~ 7 Mountain building.
13. Apr. ~~28~~ 21 Annual meeting.

GEOLOGICAL SOCIETY OF MINNESOTA

Financial Statement as of Oct. 1, 1957.

Current Account

Cash in checking account Mar. 31-1956		$ 94.77
Receipts		
From dues for 1957		375.50
From dues paid in advance for 1958		32.00
From field trips collected over transportation costs		202.65
From miscellaneous sources		53.35
Total current receipts Mar. 31-56 to 10/1-57		663.50
	Total	758.27
Disbursements		
Lectures 1956-57		$ 140.00
Postage, supplies, etc.		159.94
Loud speaker purchased		67.37
Midwest Federation dues		15.15
Miscellaneous disbursements		23.90
	Total	406.36
	Balance	351.91
Transferred to Savings account		200.00
Balance in savings account Oct. 1, 1957		151.91

SAVINGS ACCOUNT

Balance, March 31, 1956	$ 500.00
Received from C. E. Preston estate	500.00
Received from State Fair exhibit	50.00
Interest on Savings account	42.85
Transferred from checking account	200.00
Total deposits to checking account	792.85
Balance in Savings account Oct. 1, 1957	$ 1292.85

Recapitulation

	Mar. 31-56	Oct. 1-57
Checking account	94.77	151.91
Savings account	500.00	1292.85
Totals	594.77	1444.76

Submitted by
A. P. Rickmire,
Treasurer.

REPORT OF THE MIDWEST FEDERATION CONVENTION

Reprinted from the official bulletin of

THE MADISON GEOLOGICAL SOCIETY

The Midwest Federation of Mineralogical and Geological Societies held their Second Field Trip Conclave and Seventeenth Annual Convention at Platteville, Wisconsin, June 27-30, 1957. The Convention was a gratifying success; the attendance beyond all expectations. The activities ran along smoothly due to good planning and scheduling, showing a vital interest for all concerned to further the objectives of the Federation.

One observed the real rock-hound spirit when the buses were unable to get to the Tennyson mine because of rain and road repairing - the bus drivers were about to turn back when to their amazement folks were climbing out and walking down the soft red clay road or taking short cuts through deep wet grass to get to the mine. Here we were rewarded with fine lead and zinc specimens as well as an educational talk on mine operations by the superintendent. This enthusiasm and interest continued through the Convention.

A stop at Stonefield Museum, home of the first elected Governor of Wisconsin, with its many antique items in a beautifully furnished home of that period and built of native stone, proved the value of rocks for beauty as well as protection. Here too were exhibits to portray farming methods before manual labor and horse-drawn equipment were largely displaced by today's ultra-mechanization. It will provide future citizens with the history of how their forbears lived and made a living during the same period.

The view from McGregor in Iowa was awe-inspiring, natures own handiwork creating a never-to-be-forgotten picture.

Wyalusing furnished a look into the past with Dr. Ben Hur Wilson's exciting history of its discovery. The view of the confluence of the Wisconsin and Mississippi rivers from a ledge high above the water was breathtaking.

Mineral specimens were available at the Phetteplace Museum at Wauzeka in addition to the gifts of lead specimens for everyone. We had the opportunity to see the rich collection of gem stones, minerals, mosaics, mother-of-pearl inlays, and the famous Man o' War.

In Kickapoo Cave we saw an underground wonderland - stalactites and stalagmites of pure onyx.

The boat trip, enjoyed to the hilt by everyone, was enhanced by the geological comments of our devoted Dr. Frank Fleener of Joliet Illinois. Mr. R. B. Miller, owner of the "Donna Mae", made the trip so valuable by pointing out all the historical places and the development of the area generally. It was restful, carefree, effortless -- no noise, no confusion, just to enjoy vistas seen only from the river. This was one of the highlights of the convention. We saw where Julian Dubuque was buried under a lofty tower on the Iowa side. We were told of his exploits and of his marriage to Potosi, daughter of the Indian Chief. As an influential member of the Indian tribe, he became wealthy through the sale of lead, and was one of the first white miners in this area. Julian Dubuque died in poverty but left much historical data behind him.

The city of Dubuque has existed under five flags, Spanish, French, Mexican, English, and American. It was visited by Joliet in 1683 and by Dubuque in 1783. The Mississippi River draws 80% of the water that falls on the U.S.A. Much good soil is carried down the river each minute. It is not just mud, but as the great conservationist and cartoonist "Ding Darling"

said, "It is beef, pork, beans, corn and wheat" carried to the Gulf of Mexico never to be returned. This silt equals a cubical mile every year. In the last million years this has equalled one million cubical miles. At one time the Mississippi delta was at the junction of the Ohio.

Where the Mississippi River is wide, the Maquoketa shale between the Platteville and the Galena dolomite was very weak and so eroded easily. We went under the bridge at Dubuque, which cost three million dollars. This is the longest single span bridge in the United States.

Under the guidance of Mr. W. A. Broughton of the Wisconsin Institute of Technology, the Mulcany and Blackstone mines were visited. Very fine marcasite, pyrite, lots of calcite, sphalerite, lead and zinc were found. We also looked down the 800 foot shaft - the only entrance to a mine where miners enter via basket, and all material used underground goes down the same way, and all material is also brought up through the shaft. The miners shack where they change clothes is a real story-book sight. All the clothes are hung up against the ceiling to dry and each miner lowers his outfit with a rope, including his heavy boots. The room is kept at high temperature at all times. A sign tells you that a bell sounded once, twice, or three times indicates where an accident has occurred and of what nature.

The lecture on diamonds by Arthur Vierthaler, Professor of Art and Art Education at the University of Wisconsin, gave the old professionals as well as the amateurs a full story of cutting, mining, and the economic picture of the industry.

The president, Mrs. Hemingway, presented her officers and committee chairmen and paid tribute to them in poetic fashion.

Mr. Howard Knight, the new Federation president, and his officers were introduced. They, too, were given admonishments and encouragement by the past president. The 1958 Convention will be in the Chicago area, with ESCONI as host.

We move into another year, 1957-1958, with renewed enthusiasm to carry forward the objectives of our Federation to ever further heights.

The American Federation of Mineralogical and Geological Societies held their annual convention meeting at Denver Colo. June 13, 14, 15, 16.

Many St. Paulites and Minneapolitonians attended the convention and they were unanimous in their praise for a job well done.

One of our own Society members, Hazen T. Perry, was elected to the office of Vice-President for the ensuing year. Congratulations Hazen.

Next years conclave will be held in the fabulous state of Texas.

A report on the summer field trips will be given at some time during the winter lecture season. An oral report on the two weeks field trip to Colorado was given at the annual picnic on July 21st.

WHY DONT WE ALL INVITE OUR FRIENDS AND ACQUAINTANCES TO ATTEND OUR LECTURE MEETINGS. LET'S MAKE THIS THE MOST SUCCESSFUL LECTURE SEASON IN OUR SOCIETY'S HISTORY.

THE GEOLOGIC TIME SCALE

Any historical record that covers a considerable stretch of time must have some method of organizing the events with which it is concerned, in order that they may be placed in their proper time relations with respect to each other. Whenever possible, the numeroud incidents in human history are referred to certain years, either B.C or A.D. There are also larger and especially important divisions in the story of mankind, such as the Christian Era, The Dark Ages, and the Renaissance.

PURPOSE OF THE SCALE. The great number of significant events that have occurred during the vast length of recorded geologic time has made it of particular importance for geologists to devise a system of organizing these events in a systematic way according to their respective time relations. The geologic time scale has been devised for this purpose. Although the divisions are somewhat arbitrary, this scale has proved to be quite satisfactory.

THE FUNDAMENTAL LAW of SUPERPOSITION. If we observe the various undisturbed layers of rock as they are exposed in the face of a limestone quarry or in the walls of a canyon, it is immediately obvious that the bottom strata must have been deposited first and that they form, therefore, the oldest part of the section. Hence, the strata must become younger and younger from the base of the outcrop to the top. This law of superposition is the first and most fundamental principle used in classifying the rocks according to their relative age.

A normal sequence of beds is often disturbed in mountain regions where folding has occurred. Thrust faults sometimes move great thicknesses of older rock from from their original positions and leave them resting upon much younger formations. The Matterhorn is a famous example of such an overthrust mass, and in Glacier National Park Pre-Cambrian strata that have been pushed eastward several miles now rest upon beds of Cretaceous age. The many special problems of sequence that exist in regions wherethe crust of the earth has been disturbed can usually be solved by field studies and the original succession discovered.

ERAS of GEOLOGIC TIME. There have been times in the course of geologic history when over great areas of the earth's surface, mountains were formed on an unusually grand scale. These tremendous crustal upheavels are called "revolutions." During such periods of continental elevation the numerous agencies of weathering and erosion were extremely active, especially in mountain areas; and widespread unconformities were produced. These world-wide periods of diastrophism, together with the great unconformities, are used by geologists as natural and convenient points for ending the eras, which thus become the greatest divisions of geologic time. Revolutions are recurring events in the history of the earth, but they have not been evenly spaced in time and, as a consequence, different eras are of very unequal length.

PERIODS of GEOLOGIC TIME. The continents have been invaded several times, more or less widely, by bodies of marine water called "epeiric" and "marginal" seas. These invasions have occurred in great cycles, each of which begins with the slow advance of the sea over the continent and ends when the land has once more emerged from the water. The complete withdrawal of a sea at the end of each cycle is caused by a broad continental uplift, which often accompanies a mountain-making disturbance that is less widespread in its effect than are the greater revolutions. The extensive erosion and the resulting unconformity, together with the orogeny, serve as distinctive time markers that

enable geologits to separate one period from another.

EFFECTS of MINOR EARTH MOVEMENTS. In addition to the great upheavels that result from the revolutions and disturbances there have been many local crustal movements during the past, just as there are today. The region of Florida is still rising, while there has been recent subsidence in the Chesapeake Bay area. These numerous minor upheavels have caused a great many breaks in the geologic record that are entirely local in their effects, although they complicate the general situation and make it difficult to determine the exact relationships between the formations within the area of localized disturbance and those in the surrounding region.

SIGNIFICANCE of FAUNAL CHANGES. The many epeiric seas that have invaded the different continents since the Paleozoic era have been populated by varied assemblages of animals, known as "faunas." Vast numbers of these organisms died, and their shells and skeletons were buried and fossilized in the slowly accumulating marine sediments. When, at the close of each period, the seas retreated widely from the lands, the animals continued their existence chiefly in the shallow waters that covered the continental shelves, where they slowly changed or evolved during the long emergent interval. When the seas began to encroach upon the continents at the beginning of the next period, or cycle of marine invasion, evolutionary changes had produced new faunal assemblages, which were quite distinct from those of the preceding period. The fossils representing these different faunas have been collected, named, and arranged according to their proper stratigraphic positions. They are called "index" fossils, because each assemblage represents the animals that were characteristic of a certain period of geologic time.

EPOCHS of GEOLOGIC TIME. The periods are divided into epochs and these comparatively small divisions of geologic time are determined by minor and local breaks within each period, such as might be produced by a temporary withdrawal of the sea from certain areas.

SYSTEMS, SERIES, and FORMATIONS. All the rocks of a geologic period are grouped together under the name of a "system," while those of an epoch are called "series." The rocks representing still smaller divisions are referred to as "formations."

THE GEOLOGIC RECORD

The readily accessible portion of the geologic record is found in all the rocks that make up the outermost portion of the earth's crust. Some exceedingly important chapters in this story occur in the great succession of sedimentary formations in which is found the history of plant and animal life through many millions of years. Numeroud other events in the geologic history of the earth are clearly recorded in various kinds of rocks. Gneisses, schists, and truncated folds tell us of incredibly powerful compressive forces that once heaved up the crust of the earth into vast mountain ranges, which were gradually worn away by the slowly acting forces of weathering and erosion. Heavy beds of conglomerate often reveal the former existence of steep, rocky shores and swiftly flowing streams. Coralline limestones, even though they occur in high latitudes, are a reminder of clear, warm, and even tropical seas.

The geologic record far surpasses all books in the unlimited variety of information that it contains and in the supreme importance as a matter of recorded history and as a means of understanding the present and of forecasting the future.

FRAGMENTARY NATURE of the RECORD. There is no place on earth where a complete record of all the events in geologic history has been left, and there is no possibility that more than a small part of the entire story will ever be known. The information that geologists possess is an assemblage of facts that have been gathered from all parts of the world as a result of studies made by thousands of workers.

UNCONFORMITIES. Since the very earliest eras, weathering and erosion have been constantly acting upon the surface of the earth, breaking up rocks and carrying the fragments, large and small, to new places. Although the agencies usually work very slowly, after they have been operating for millions of years vast mountain ranges may have been removed, and thus a great part of the geologic record may have been destroyed. All the destructive forces that have been active through the ages are responsible for the removal of thousands of feet of igneous, sedimentary, and metamorphic rocks; and, although erosional remnants may be left in a few places, those parts that have been carried away can never be recovered.

When rocks are weathered and transported bit by bit to some other locality, they are furnishing material with which to write new chapters in the geologic history. Nature's forces are thus constantly at work tearing down in one place and building up in another - processes that have been going on for countless ages. The great number of erosional unconformities found throughout the different rock sections in all parts of the world are evidence of missing pages - sometimes, missing chapters - in the story of the ages.

LACK of DEPOSITION. Geologists are greatly dependent upon sedimentary deposits for information about the geologic past; there are breaks in the record and important parts of the story may be missing. Large areas in the state of Florida are now only a few feet above sea level. These places are neither receiving any important quantity of sedimentary material nor being subjected to vigorous erosion. This condition has existed since Florida appeared above the sea, several millions of years ago. Such a lack of deposition is due largely to the fact that there is no source of sediment available.

In Michigan and the neighboring states, no geologic record is known for the entire Mesozoic era or for almost all of the Cenozoic era, probably because no appreciable quantity of sediments representing these eras was ever deposited in the Great Lakes area. It is thus impossible to write the Mesozoic and Cenozoic geologic history of Michigan and its neighbor states.

OLDER ROCKS ARE BURIED beneath YOUNGER DEPOSITS. Wherever sedimentary or igneous rocks accumulate, either on land or beneath the sea, they always cover up some older deposits, which eventually may be deeply buried. In this way a large part of the geologic record is concealed and has become inaccessible. If mine shafts penetrate some of the deeper formations, their presence may be thus revealed; but under such conditions, a thorough study of the rock is impossible. Drill cores may bring up from thousands of feet below the surface samples of sediments containing identifiable fossils; yet no great amount of information can be obtained from such small quantities of material. Even such deep burial is not necessary in order effectively to conceal the rock, because geologists are usually able to examine only those beds that are actually exposed at the surface.

Many of the best outcrops of rock are found in quarries or along the walls of canyons, where only the edges of the various strata can be studied. A thorough examination of the various beds is obviously impossible under these conditions.

METAMORPHISM. The powerful forces that cause regional metamorphism may alter the rocks over a large area so profoundly that their nature will be completely changed. While this does not destroy the rock itself, the original record is either obliterated or rendered so obscure that it cannot be read. Fossiliferous shales may be changed into schists, and all traces of the organisms are then destroyed. Many limestones have been altered into marbles, with the result that the fossils they contained are nearly always so distorted as to have lost their value.

ROCK OUTCROPS THAT HAVE NOT BEEN STUDIED. One very obvious reason why knowledge of geologic history is so incomplete lies in the fact that not all the accessible rock outcrops have been studied by geologists and that many of them have been examined only superficially. Time may correct some of this deficiency.

CORRELATION. When a study is being made of the rocks in a certain area the geologist must determine the particular period during which the beds were deposited and discover just how closely the various outcrops are related one to another. Comparisons will also be made with formations of the same age in other regions. This process of comparing one exposure with another in order to determine their precise relationships, including the age equivalence, is known as "correlation."

The geologic history of North America is made up of information discovered by great numbers of geologists working in many different localities; and all the events in this complex historical record have had to be correlated, or placed in their proper age relations with respect to one another.

METHODS of CORRELATION. By Lithologic Similarity. When several rock outcrops within a small area have very similar lithologic characteristics, they are probably of the same age and may properly be correlated. This is sometimes the only method of correlation that can be used, particularly in the case of igneous and metamorphic rocks where no fossils are present. Correlation by means of lithologic similarity has little value where the outcrops are far apart, because rocks belonging to widely separated periods of time are sometimes found to be almost identical lithologically.

By Similarity of Sequence. The following hypothetical case will serve to illustrate correlation by means of similar sequences. Two rock sections, each 100 feet thick, are found in the same region. A comparison of these sections shows that they are very similar throughout. The same kind of rocks are found in both places and the beds follow each other in the same order from bottom to top. All the pecularities of lithology in one section are found in the corresponding layers of the other. Such striking similarity is strong proof that the rocks in the two exposures were deposited at the same time.

This method of correlation may be used even though the sequences are not exactly the same. It is possible that certain beds might be missing from one section, either because of erosion or because of lack of deposition, yet the general sequence of strata would be very much alike.

A certain well-defined layer, with easily recognizable characteristics is sometimes found in a number of different outcrops, and, wherever this stratum occurs, it always occupies the same position in the section with respect to the other beds. A horizon marker so consistent is often very useful for purposes of correlation.

By Continuity of Outcrop. If a certain outcrop of rock can be traced as a continuous exposure from one place to another, then it is clearly of the same age throughout its entire extent. This is a very exact method of correlation wherever it can be used. It is sometimes employed in canyons or along river valleys, where exposures may extend for several miles without a break.

By Means of Index Fossils. Each one of the geologic periods above the Pre-Cambrian is characterized by a certain faunal assemblage different from that found in any other period. Such organisms, which - as we have noted - are called "index" fossils, are used for purposes of correlation, especially in formations of marine origin, where the same kind of fossils have a wide distribution. Uniform environmental conditions prevailed throughout several of the epeiric seas that covered North America, and this enabled many of the marine organisms to migrate widely so that they became cosmopolitan types. Such forms permit correlation over distances that are almost continent wide and, in a few cases, even intercontinental.

The task of collecting and identifying the fossils that represent the faunas of the different periods has been accomplished by many geologists, working in all parts of the world.

When this method of correlation is used, it is not necessary that precisely the same species of fossils should occur in all the localities that are being compared. Slightly different environmental conditions might have existed in one of the places while the sediment was accumulating, thus causing minor faunal differences. A small number of fossils that are highly characteristic of a certain formation are better for purposes of correlation than a large number of organisms whose exact positions in the geologic column are not known.

It is possible to establish a relationship between deposits that were laid down upon the land and others that were formed at the same time in the sea, if both contain fossils that are known to be of the same age, even though the organisms in the two places are quite different.

DIFFICULTIES of CORRELATION. Different Contemporaneous Faunas. The correlation of continental deposits is sometimes difficult or even impossible because diverse environmental conditions of the land during the past often give rise to different contemporaneous faunas in localities that were close together. A plentiful supply of rainfall might produce a heavy forest growth on one side of a mountain range while, at the same time, semiarid conditions on the opposite side would cause the spread of open plains. The kinds of animals found in these two regions should normally be quite different - a fact that might lead to many difficulties in correlation at a later time.

Proof of Contemporaneous Deposits. Outcrops that are said to be of the same age may not be contemporaneous with each other. A certain deposit made during the early part of an epoch might contain a fauna very similar to that of another deposit laid down considerably later, and the two formations would probably be correlated. It is usually very difficult, or even impossible, to prove that two or more formations were deposited at exactly the same time.

The above article extracted from the book

HISTORICAL GEOLOGY

The Geologic History of North America

by
Russell C. Hussey
Associate Professor of Geology, University of Michigan

Permission of McGraw-Hill Book Company, Inc.
New York and London