Michigan Department of Conservation
Information & Education

GEOLOGY, or EARTH HISTORY and MINERAL RESOURCES

Suggested Projects for Classroom, Laboratory or Field Trip 1953

Although these suggested activities are apportioned to grade levels, it will be obvious to any teacher that nearly all can be adapted to higher or lower levels. It is suggested that teachers using this outline read all activities and select those suited to, or that can be adapted to, the grade in which he or she is interested.

These activities are, in part, based on Michigan, but the principles involved may be applied to any area. Many topics may seem to be more related to geography, history, social science – but all are problems in geology, also.

Attitudes to develop:

A) 1. Geology is earth history. The earth has a history just as you, your school, your town, your country has a history - a past, a present, and a future. Rocks tell the story of the earth.

2. The earth is more than three billion years old, but the processes of change that started when the earth was young are still going on everywhere, all the time.

3. With knowledge of earth history, we can develop a better understanding of our modern way of living, of our agriculture, our industry, our recreation, and our culture.

4. Knowledge of geology has made it possible to locate deposits of vital minerals and rocks necessary for modern society. "The minerals of the earth are the prime necessity for war and peace."

5. Earth history is engrossing, and we can study phases of it anywhere.

6. Geology is a sound "basis for study of conservation - literally from the ground up. (Note geology in Soil Conservation and Land Use).

B) 1. The earth is continually changing^

2. Most changes in the earth and on its surface occur slowly through hundreds and thousands of years. Earthquakes, volcanic activity, cave-ins, floods, and shore erosion are rapid changes.

3. Heat and cold, wind, moving water, moving ice, and men are agents that change (weather) the face of the earth.

4. The earth is made of rocks. Rocks are made of minerals.

5. Weathering changes rocks and releases minerals. (See Soil Conservation and Land Use, p. 1, I-A; p. 2, II 9; p. 3, II – 12, 17, 19 - 21.)

6. Minerals are basic plant food. Life would be impossible without them.

7. Minerals are metallic - gold, silver, iron, and others; and non-metallic - salt, gypsum, water, and others.

8. Minerals are nonrenewable resources, or, Nature renews them so slowly that they do not become available for man's use.

9. Use of mineral resources has given America our high standard of living and our leisure time.

10. Food comes from renewable resources - plants and animals. Animals live upon plants, plants live upon the minerals in the earth and some of the gasses in the air. Shelter and clothing come from nonrenewable as well as renewable resources.

II. POSSIBLE ACTIVITIES RELATED TO GEOLOGY

Kindergarten - Early Elementary (Kindergarten 2):

(See Soil Conservation and Land Use Activities 9, 10, 11-21, 25, 26, 35, 53)

1. Collect stones for a fish bowl. Discussion: Where found? Are they all alike? For what else are the stones used?

2. Have the children make lists of what they ate today that was not animal or vegetable.

3. Of what are the flower pots made in which you plant seeds? (See p. 2, Soil Conservation and Land Use Activities Outline.)

4. Fill one pot with good foundry sand or with "sharp sand" from a greenhouse; plant some seeds in it, and compare what happens with the seeds planted in good soil. Grind chalk to powder, plant seeds in it. What happens?

5. Cover a bowl or glass with gauze. Put seeds on gauze. Keep glass filled so that gauze is always moist. Note what happens to the seeds.

6. Of what are the pots and pans and the stove made where you food was prepared? List the materials of which the furniture in the classroom and the school building are made. Which relate to geology?

7. Examine the sand with a magnifying glass. Discuss crystals. Use models of geometrical solids in discussing crystals.

8. Discuss the three kingdoms - plant, animal, mineral. Things that are neither animal nor vegetable are minerals, like salt, water, glass, iron.

Early Elementary - Intermediate (2-3-4):

9. Watch water evaporate in a flat glass dish. Discuss what happens to the water. Discuss what is left in the dish.

10. On a snowy day, examine snowflakes under a hand lens. It is advisable to let the snowflakes fall on some dark material. Snowflakes are water crystals. Water is a mineral. Notice that the snowflakes are six-sided crystals. A good follow up is to allow the children to cut paper snowflakes. Use ice crystals formed in a refrigerator unit when there is no snow.

11. Do farmers like snow? Discuss snow on a farm, in a city. What about rain?

12. Fill a pan with snow. Guess how much water will be in the pan when the snow melts. Pack the snow. Discuss what happens. Place a deep container where rain will fall freely, not splatter, into it. Measure the water in the container after a rain.

13. For an arithmetic lesson, compute the amount of water that fell as snow on your school ground. Compute the amount of water that fell on the school ground during the rain.

    Keep a chart record for a term, or year,

14. Make crystals. Dissolve powdered alum in hot water. (Bring water to the boiling point, turn off heat, add alum slowly until no more will dissolve.) Suspend a string in the water and set aside to cool. If a pyrex dish or a glass beaker is used, the children can watch the formation of the crystals. Nature makes crystals from hot and cold rock liquids in the earth.

15. Find some rocks with crystals and compare with the alum crystals. If you are near a museum, visit the mineral collection and study the crystals. Use models of geometrical solids in discussing crystals.

16. Watch icicles form. The icicles are made of tiny crystals of water (ice).

17. Salt is a mineral. Examine table salt under a hand lens. The crystals are cube-shaped. Each mineral has a shape of its own. How is salt used in your home? Find other uses for salt.

18. Of what is you schoolhouse made? If it has a stone foundation, examine the stone. Examine the gravel in the road, or schoolyard. Is it like the salt or alum crystals? If your schoolhouse is brick, from where did the brick come? Brick is an artificial rock. Find out from what bricks are made. Cement and concrete are artificial rocks. From what are they made?

19. Rock is made of mineral crystals locked tightly together. Some rocks have only one mineral. Others have several minerals. Visit a gravel pit and collect rocks of each type.

20. Examine the sidewalks near your school. Are the edges smooth and firm? Hard surfaced roads and sidewalks are man-made artificial rocks, and nature treats them just as she does the rocks she makes herself. If the edges of the rock are broken, discuss how it happened (heat and cold, tree roots, people walking). Discuss what will happen to the broken pieces when the next rain comes. Notice how the land slopes from the sidewalk. Will the slope have any effect on what happens to the rainwash? The same forces that break up the pavement break up natural rocks.

21. The broken to sidewalk (rock) particles are weathered rock. When picked up and moved by rainwash, and settled somewhere else, they are sediments, and will harden into another rock. (See Soil Conservation and Land Use Activities, page 2, Nos. 9-11.)

22. To show what happens to sediments, mix sand with water, spread on a flat dish, let water evaporate. Notice how hard the sand gets and that it cracks. Such cracks in rocks are called joints.

23. Try the experiment with clay, with muck, with lime. Vary the experiment by evaporating near heat, with a fan plowing hot or cold air.

    Drop some vinegar on the lime. Discuss what happens. Try the vinegar on other rocks and see if they will fizz. Better, obtain some 10% hydrochloric (muriatic) acid from a drugstore for this experiment. Vinegar does not always work. Gather some snail and/or clam shells. Try the experiment on them. Try it on bones. Lime is used by animals to build their shells and bones. When they die in the sea, shells of sea animals sink to the bottom and become buried in the lime mud. After a long time, they are changed to stone (petrify) and we call them fossils. Some plants also take lime from water and build masses of lime mud that become rock. Some plant-deposited lime is marl.

24. Make a sand table. (See Trees, Wood Lots and Forests Activities Outline. page 3, No. 16.) Pile a mixture of sand, gravel, lime, clay, on the table. Let water drip through the mix. Note changes. Vary the incline of the table and see what happens. Vary the rate of water flow. Compare results. Discuss erosion. If you can get a piece of sod, cover the sand, gravel, clay pile with it and repeat the experiments. If you cannot get the sod, a couple layers of blotting paper can substitute.

25. If you can arrange your sand table so that the sediments are washed into a glass-sided sink or aquarium, you can see the deposition of the sorted sediments - gravel, sand, clay, lime (and all sorts of mixtures) and explain to the children that that is the way sedimentary rocks are made the gravel becomes conglomerate; sand becomes sandstone; clay or silt becomes shale; and lime, limestone. (See No. 85 (1) “Make a collection.”)

26. Compare with the work of streams in the vicinity. Compare with the work of rainfall, snow melt, on the school grounds.

27. Fill a fruit jar half full of water. Put sand and pebbles of several small sizes into the jar. Shake the jar. Notice how the material separates into layers. Add some clay or chalk dust. Shake the jar again; discuss what happens.

28. Sediments deposited by rivers are in similar layers. We call each layer a stratum; several are strata; and when the deposits have the water squeezed out and become rock, they are called stratified sedimentary rock.

29. Do you have a coal furnace? Have you ever seen a clinker in a coal furnace? That is mineral matter which has been melted in the heat of the furnace.

    Mineral matter that has been heated in the earth is called igneous or fire rock. When it cools, the various minerals crystallize as the alum did, or as fudge does. If it cools slowly, the crystals are large. If it cools rapidly, fine crystals are formed. If it cools very rapidly, the rock is glassy and no crystals can be seen except with a very high-powered microscope. Such rocks are called igneous, crystalline, and commonly, granite. They are the oldest rocks and were weathered to form the sediments and they are really the parents of sedimentary rocks.

30. Nature changes rocks. In some places she melts them just enough so the crystals can get together in bands. In other places, the rocks are baked harder - like the slate of your blackboard - that was once a clay mud. The rocks that are changed from one form to another are called metamorphic or changed rocks (granite to gneiss; sand to sandstone and quartzite; clay to shale to slate; and lime to limestone to marble). In the winter, pack snow (see No. 12). Note the changes. Actually, the soft snow crystals have been changed by hand pressure into rock - ice - an example of a metamorphic rock.

31. Take a trip in your town and see how many buildings are made of stone. See if you can determine the kind of stone: Granite, slate, limestone, marble, shale, sandstone. Did it come from your locality? Did the marble in the bank come from your town?

32. Take a trip to a gravel pit. See how many different kinds of stones you can find. Note if any of the stones have shells in them. Discuss fossils. How did so many different kinds of stones get together?

33. Break a rock. Note the difference between the old and the fresh surface. Discuss reason for the difference and if it has any relation to our food supply.

34. Find a rock with a plant growing on it, scrape off the moss or lichen, or look at the plant roots. Discuss how the plant is breaking up (weathering) the rock, and how soil will be made when the plant dies and mixes with the broken up rock.

35. If a quarry is in your neighborhood, get permission to visit it. Collect rocks and stones found there. Discover fossils. Note vegetation. Count the numbers of plant species. Note any evidence of animal habitation.

36. Find some one who can tell you the history of the quarry or gravel pit. How did the quarry or gravel pit benefit your community?

37. Write a story about the quarry or gravel pit for your social studies or English class.

38. Draw a map of your classroom. Discuss scale. Draw a map of your school grounds. Discuss topography - highlands, lowlands, rivers, and other features.

Intermediate - Later Elementary (4-5-6):

Many of the activities listed before can be brought to Later Elementary level.

Consult Soil Conservation and Land Use p. 3, 12-21 - all geological processes

39. Make a map of your schoolroom, school property, city block. Discuss map making. Discuss section, township, range.

40. Make a rock collection. Discuss their shapes and colors, as well as their minerals. Determine which of nature’s forces shaped the pebbles - wind, water, glacier. Coal is classified as a rock. Collect different kinds of coal for an exhibit. See if leaf prints can be found in the soft coal. (See last page - “Have the children ...”)

41. Have the children write the stories the rocks tell for an English class.

42. Discuss the difference between the freshly broken rock and an old surface. What became of the worn off rock!

43. Find a rusty piece of rock, or a rusted pipe. Somehow, the iron in the rock changed. To show how, place a piece of iron in a dry place, and another in a damp place. Watch them from day to day and see which weathers, rusts, first. This chemical weathering, as opposed to mechanical weathering (breaking up, but not changing). Rusting is a union of the iron with the oxygen of the air, a very slow form of burning or combustion. Quick union of oxygen with metal causes an explosion, flash bulb.

44. Chemical weathering has been important in making our iron ore, and our limestone, as well as our soil particles.

45. Locate a stone building, a stone foundation, boulder, monument, cemetery. Discover evidences of, and kind of, weathering.

46. Collect articles of copper, silver, iron, aluminum, magnesium, lead, tin, etcetera, for display. Study the background and the uses of the various metallic minerals. Which metals come from Michigan? History, English, and Social Science teachers, please note: Who first used the iron, copper, etcetera, of Michigan?

47. Visit a gravel pit. At its edge, find the depth of the top soil. Note whether the gravel is found in layers showing the action of water in sorting materials, or whether it is unstratified (generally mixed up). Notice whether the gravel is fine or coarse. Notice whether or not water is in the bottom of the pit. If so, this is probably the water table of the surrounding area. Where did it come from?

    Find fossil rocks showing evidence of an old sea. How did they get in the gravel pit? Discuss effects of glaciation and placement of the gravels. Note vegetation in new and old parts of pit. For what is the gravel used?

    Make a collection of the different kinds of stones in the gravel pit. How did so many different kinds get together? In the classroom, have the children show on a map of Michigan where similar stones can be found. Consult the geological map of Michigan.

    If you cannot visit a gravel pit, perhaps you can find some construction where gravel has been used and make a collection from the leftover gravel. Test the stones for hardness - scratch with fingernail, knife, piece of glass. See if any fizz with acid. Sort them into igneous, sedimentary, metamorphic (if possible). Why are the igneous, crystalline pebbles most numerous?

48. After a heavy rain, note the effect of the water on the school yard. Notice the effect on baseball fields, grass plots, along sidewalks and on tree areas.

    For a math lesson, measure the rainfall. Compute the amount of rain on the school property. Be sure the container is placed where rain can only fall, not splatter or fall from roofs into it.

    Make a sand-table display showing streams, industries located on their banks which make use of the water, recreational values where streams are used by fishermen, campers, picnickers. How do industrial wastes affect the fisherman, camper, and picnicker? Find out what is being done with the industrial wastes from the industries of your town.

49. Watch the cloud changes when the weather bureau forecasts a storm. Draw pictures of different types of clouds in the order in which they appear in the sky before and after a rainstorm. Keep a record of cloud changes for a day, a week, a month. Keep a record of the weather for the same time. Discuss relationship.

50. Visit a weather bureau if one is available.

51. Set up a miniature weather bureau in your room. Make a simple barometer, the directions are found in most general science books, and keep a record of changing weather conditions. From a study of barometric changes, clouds, and wind direction, see if you can make a weather prediction. Try this after three or four days' observation.

52. From your nearest local weather bureau, find the average annual inches of rainfall for different sections of the state. Find out how much water soaks into the ground; how much runs to lakes and streams; how much plants use; how much plants transpire. Many problems in arithmetic can be evolved from such data: i.e. Compute the amount of water used In preparing your dinner.

53. Study the source of the water supply of your school. Study relation of water to plants, people, preparation of food, industry.

54. Have some of the community's water tested.

55. Visit a purification plant, reservoir sewage disposal plant, or other public utilities connected with water supply.

56. Find out how much water is used by industry in your town. After being used, where does it go? Do any industries re-use water?

Intermediate - Junior High School (6-7-8):

Many activities for Elementary
can be fitted to Intermediate level.

57. Discover the use of minerals, metallic and non-metallic, in the classroom and in the home. Among these might be chalk, graphite (lead pencils), copper, tungsten (light bulbs), iron and steel, porcelain, crockery, china, glass, aluminum, salt, carbon, zinc, lead, slate, etcetera. Compare the minerals used by Indians or other primitive peoples with the minerals you use daily.

58. Make a map showing the mineral localities of Michigan and draw lines from the localities to your town showing what Michigan minerals are used by the industries of your community. Make a similar map showing how your community depends on the United States as a whole. Make a map to show which Michigan minerals enter your home.

59. Make a map to show the location of the mineral resources of Michigan. Show by route lines the resources that come to your community. Use one color for those resources that supply your industries, and another color for those resources that reach you indirectly.

60. Visit an oil well, a quarry, a mine shaft, a gravel pit, a sand pit, if any of these are near your community. Perhaps the person in charge will allow you to take samples back to your classroom.

61. On a field trip, carry a map and locate various glacial features, such as moraines, till plains, boulder clay, gravel deposits. Account for the many different rocks and soil types found in a small area. Discuss good land uses of these glacial deposits.

62. Make a large map of the county, showing important geological features, such as streams, direction of stream flow, lakes, general moraine, ground moraine (till plain) areas, and outwash plains. Avoid having the map become too intricate. Note relation of agriculture or other land use to the geological formations. Note relation ecology and geology.

63. Visit an erosion gully, a small temporary stream, or a rivulet made by melting snow. A gully on the playground or nearby field will do. Mark where water cuts a new bank, and mark where water drops some of its load. Allow the students to pretend this is a miniature of a large river, with farms all along the river. Determine which farms are losing soil as a result of the river's action. Let the students act as soil conservation specialists, and determine what is to be done to alleviate the condition. Have the students write a story of the relation of earth history to the farm and farm practices. See other suggested Activities.

64. Visit a stream. Note the direction of the current; the character of the valley. Notice the position of cutting on the banks and where sands or gravels are being deposited. Discuss how stream improvement practices change direction of currents, create better fish habitat, control bank erosion. Man copies nature when he makes stream improvements. (See No. 60, Trees, Woodlots, and Forests.)

65. Visit a lake at various seasons of the year to evidence important geological changes that take place. Note the effect of the ice on the shore line plant growth, on the lake bottom, wave action, and other effects.

66. Investigate the source of your community's water supply. Find out the amount used per capita per day. List all the uses of water in your home, in your community. Have each pupil determine how water has been of value to him in one day.

67. Discuss causes of water pollution. Both ground water and surface water can be, and are, polluted, in some areas. Discuss methods of remedying water pollution. Discuss the disposal of industrial wastes in your community.

68. If local water supplies are from individual wells, map your community to show well depth and quality. Include the amount pumped from each well per day.

Junior High School - Senior High School (8-12):

All Elementary and Intermediate Activities
can be reviewed and/or used on High School level

69. Find the history of local supply of water wells gone dry. What is the history of new sources? If you are in a rural school, determine the well depth, the kind of well, when it was used last. Draw conclusions as to what is happening to the water table. If you live in a town, find the history of the water supply since the community was founded. Determine the cause for any change.

70. Determine if local water use has "bad features, and set up a plan for better use. See also 66, 67. Do you know of any companies that have solved pollution problems by finding a use for waste that formerly polluted streams or ground water? Discuss industries that have made use of waste in your community and elsewhere: i. e., brine waste from salt wells (Dow, Wyandotte and other chemical plants); waste from petroleum wells. Use of waste makes wealth.

    Discuss utilisation of other mineral wastes, such as from quarries, mine dumps and others.

71. Visit an oil field, if possible. Find out what type of rock is most likely to yield oil. Write the fascinating story of how oil came to he in the rock, and the relationship between old seas that covered the state, the plants and animals that lived in them, and petroleum.

72. Find what laws we have regarding the flow from an oil well and why they are good laws.

73. Determine why a law was written to prohibit oil well drillers from abandoning a well without first plugging or casing the hole thoroughly. Investigate the relationship this has to a water supply.

74. Chart the uses of Michigan's rocks and minerals, or prepare reports on the various minerals found in the state. Bring out economic and social significance of the discovery and the processing of these minerals.

75. Write stories of the origins of all mineral resources of Michigan. Make maps and charts to show how these resources have been developed.

76. Discuss and chart the uses of water in agriculture, manufacturing, recreation, transportation, and for domestic purposes. In the same way, discuss and chart the uses of iron, copper, salt, bromine, gypsum, gravel, limestone. Did primitive man use any of these resources?

77. Look in the advertising section of any magazine, and list those advertisers whose businesses depend directly on use of minerals. List those industries to whom a geologist is of value.

78. Chart the occupations of men represented in the production of: Salt on the dinner table; the stove on which dinner was cooked; the books you use. Use your imagination and ingenuity to suggest other topics.

79. How has geology - earth history - affected your community? its location? industries?

80. Discuss the effect of the mineral resources of Michigan on the history of the United States.

81. Discuss the origin of the Great Lakes and the relation of the Great Lakes to United States history and economy.

82. Discuss how glaciation helped to cause the Civil War.

83. Outline the history of your town. What influenced its location? What were its first industries? What are its industries now? Why the change? Discuss the part, if any, played by minerals in the change. Determine if the local water supply had anything to do with industries coming to, or moving from, your town.

84. Write stories of the daily life of a family in the Stone Age; in the Bronze Age; in the Age of Iron; the Age of Steel; of Today. Note the minerals you must discuss in the story of each family.

    Write stories comparing the minerals used in Civil War time and today. Only seven minerals were in common use when America was discovered. Only 14 were in common use in 1900. Today, we use 47 minerals.

85. Have the children:

    (a) List as many products as they can that are made entirely from rocks and/or minerals.

    (b) List as many non-metallic products as they can that require the use of minerals in their manufacture.

    (c) Find pictures in the advertising sections showing mineral uses.

    (d) List all the minerals and mineral products used on a farm.

    (e) List all the metals in the classroom.

    (f) List all the other minerals in the classroom.

    (g) List all the minerals of which they made use in today's activities; list the minerals, other than those in food, that were needed today to feed, clothe and shelter them.

    (h) As a geography lesson, have them locate the sources of the minerals in these lists.

    (i) How does earth history affect a farmer? a manufacturer? your community? happiness? culture?

    (j) Discuss: “The culture of North America is based on the use of its natural resources; its high standard of living on the use of its mineral resources.”

    (k) List the mineral resources mentioned on the financial page of your morning newspaper.

    (l) Make a collection of stones illustrating the three classes of rocks - igneous, sedimentary and metamorphic. Make a chart or display showing how these rocks may be changed into other rocks by heat and pressure (limestone to marble; shale to slate). Show how these rocks break up into minerals by the agents of weathering (rain, wind, plants and animals, chemical changes) and become part of the soil. What is the relationship of water to the soil? Organic matter? Plant some seeds in a soil formed from limestone and compare with seeds planted in a soil formed from some other rock.

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   What things are made of
   Water
   Clouds, rain and snow
   The scientist and his tools
   Water supply
   Soil
   The earth's changing surface
   Heat
   Matter and molecules
   Ask the weatherman
   Our ocean of air

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