Developing a Concept of Geological Time

• David W. Kramer, Southeastern Campus, Indiana University, Jeffersonville

The author presents a tested classroom device to help teachers develop a concept of geological time with their students.

One of the most important concepts of science, geologic time, is usually one of the most difficult for students to fully understand. At one time or another, most of us have learned the sequence of the geologic periods with the aid of a clever mnemonic device. A few of us may even have memorized the duration of each period as expressed in millions of years. Such a rote memorization is meaningless to a biology student faced with the problem of understanding and appreciating biological evolution.

Modern textbooks have attempted to demonstrate the relative length of the periods and eras through the use of properly spaced diagrams. But careful observation will indicate that the Precambrian is telescoped into the last half-inch at the bottom of the diagram. This very long period was once thought to be less interesting to the biologist since very few fossils are present in Precambrian strata. With increased research in molecular biology and a renewal of the question of the origin of life, the Precambrian has suddenly been forced into the spotlight. Authors and editors admittedly face a difficult task in illustrating geologic time to scale because of limitations of page size and type face. But the teacher is not restricted in this way.

A simple, inexpensive teaching aid can easily be constructed to dramatically demonstrate the geologic time scale. It consists of approximately 44′ of 1½″ grosgrain ribbon in five colors each representing an era (Table 1). These five lengths of ribbon are sewn together in proper sequence and are subdivided into periods through the use of a black felt-tip pen (Table 2). Each period is appropriately labeled. During a discussion of geologic time, the ribbon can be stretched around the room or it can be fastened to the wall if it is to be used for several days. (Fig. 1).

After discovering its value, some teachers may wish to make the time scale more permanent by painting it on the classroom wall or in the corridor. In this case, the ribbon can serve as a tape measure in laying out the scale. Such a geologic time scale can be quite decorative as well as educational. The extinct and recent animals and plants can be painted on the wall in the proper places or one can mount magazine illustrations or even fossil specimens on free-forms of Bristol board and attach them to the wall using the best principles of design. (Fig. 2).

Table 1. Ribbon required for a model of the geologic time scale in which 1 cm = 4 million years (allowing for seams).

Era	Suggested Color	Length
Cenozoic	White	1.0 ft
Mesozoic	Yellow	1.5
Paleozoic	Pink	3.0
Proterozoic	Gray	12.5
Archeozoic	Black	26.0

Table 2. Geologic time scale.

Era	Period	Duration (Millions of years)	Scale Length (1 cm = 4 million yrs)
Cenozoic	Quaternary	3	0.75 cm
	Tertiary	62	15.50
Mesozoic	Cretaceous	70	17.50
	Jurassic	45	11.25
	Triassic	50	12.50
Paleozoic	Permian	50	12.50
	Pennsylvanian	30	7.50
	Mississippian	35	8.75
	Devonian	60	15.00
	Silurian	20	5.00
	Ordovician	75	18.75
	Cambrian	100	25.00
Proterozoic* (Algonkian)	Precambrian	1480	370.00
Archeozoic (Archean)	(Precambrian)	3000	750.00

* The division between the Proterozoic and the Archeozoic as well as the total age of the earth are disputed (3).

This could provide an excellent opportunity for a class project. The students can carry out the necessary research in the library, finding the latest geologic time scale (1), the animals and plants characteristic of each period, and the geologic phenomena of each period (2). During this information-gathering exercise, the teacher might stimulate discussions of fossils and processes of fossilization, geology, paleoclimatology, the origin of the earth, the origin of life, and, of course, evolution. The following questions are a few of the many which might be raised for discussion: 1) In terms of the geologic time scale, how will evolution be affected by an intelligent animal like man? 2) What will be the effect of our current population explosion? Is it a short-term or a long-term event? 3) Is man the end-point of evolution?

The geologic time scale will demonstrate vividly that the human species (Quaternary) is a very recent evolutionary invention or experiment, a sobering thought in this age of machines and the supremacy of man.

References to Literature

1. Kulp, J. L. 1961. Geologic time scale. Science 133(3459): 1105-1114.
2. Johnson, Willis H., Richard A. Laubengayer,

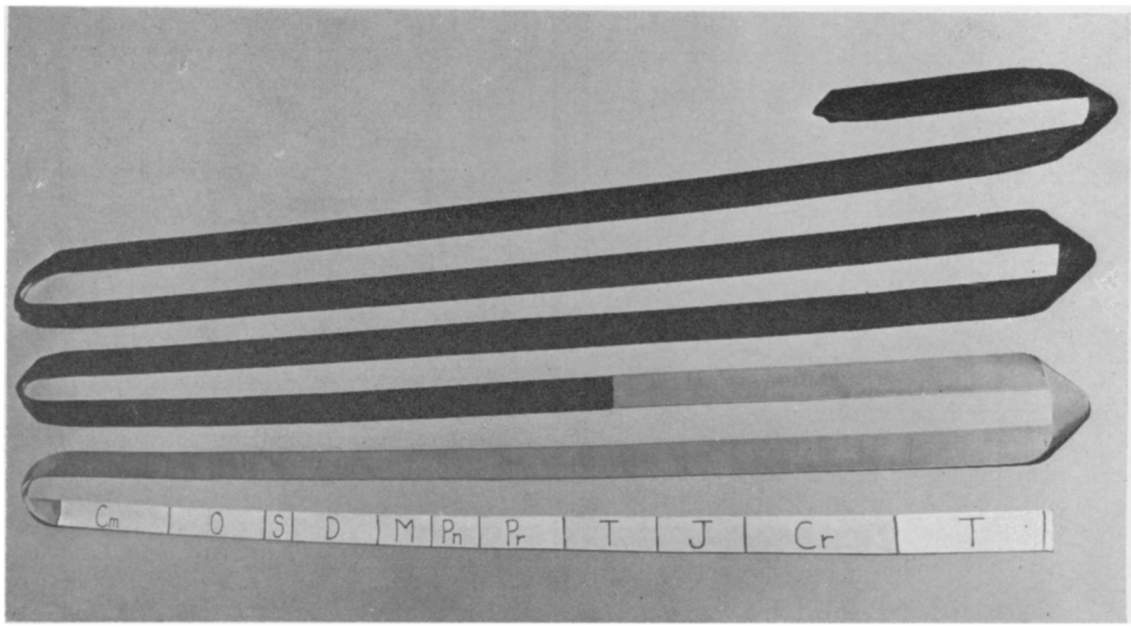

Fig. 1. A ribbon model of the geologic time scale.

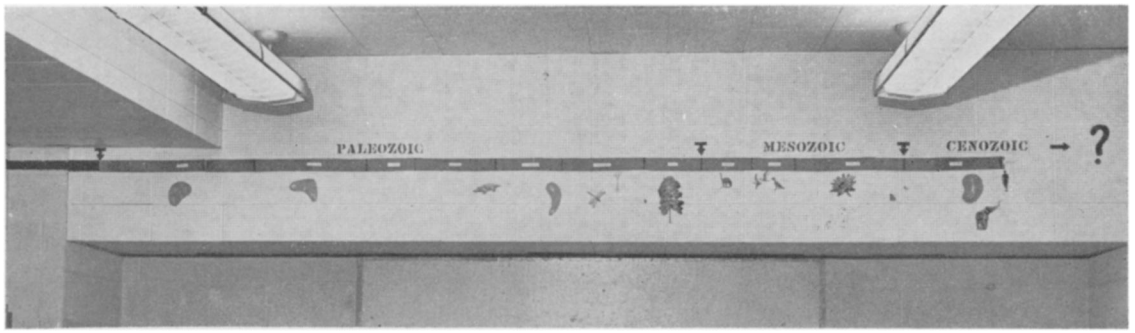

Fig. 2. A portion of the geologic time scale as permanently installed on a classroom wall. The last three Eras shown in this figure are preceded by a 39.5 foot black line representing the Precambrian.

and Louis E. DeLanney. 1961. General Biology. New York: Holt, Rinehart and Winston, p. 576.
3. Moore, Raymond C. 1958. Introduction to Historical Geology. New York: McGraw-Hill Book Co., Inc., Chapter 1.

Back Injuries

The American Medical Association's Committee on Medical Aspects of Sports again reminds coaches and trainers and parents of football players to be wary of the athlete who has continual or recurring back pains, even if the pains are not disabling.

Serious disabling injuries of the back are unusual in sports among persons who have a sound spine to begin with. Contusions of the muscles, strains of the ligaments and even fractures of various aspects of the lumbar vertebrae ordinarily heal under medical supervision with no persistent disability in from two to six weeks. If disability persists beyond six weeks, the physician will search for some underlying defect in the spine or its juncture with the sacrum.

Congenital defects of the spine are rare and might not be detected. Unless they produce obvious external signs they are not ordinarily recognized during childhood. During adolescence, however, heavier stresses are placed on the spine by the greater size and weight and more strenuous activities of the individual. When the boy or girl becomes active in athletics, pain in the back or spasm of the back muscles may appear for the first time.

Unless there has been a history of injury these difficulties are often discounted as "back strain" or "growing pains." Continuation of athletic activities, especially contact sports such as football, may then result in an injury which becomes chronically disabling because of the underlying defect.

The AMA declared that the only way to prevent serious chronically disabling back conditions in young athletes is by detecting and rigidly excluding those who have significant birth defects of the spine from sports which pose a high risk of injury to the back. The significance of a defect can only be determined by medical evaluation. This can be done, first, by requiring a preparticipation health examination including a careful history of all candidates for these sports. Any history of frequent back symptoms demands a further examination, including x-rays. Significant limitation of forward or side bending or pain produced on straight leg-raising provides evidence of possible disorders.

Excluding such individuals from sports with a high risk factor may seem harsh when the player is able. But counting on such a player for continuing service can have disastrous results, both to the team which risks losing his services at a crucial period in the season, and to the individual who risks disabling injury.

Double Trouble

Tichocephaly (two-headedness) in snakes occurs about once in every 90,000 individuals.