

40 FOSSIL HISTORY OF THE ELEPHANT

On a geological time scale, the emergence of the elephants was fairly rapid. Fossil data suggest that the earliest true elephants arose about seven million years ago. Biologists today generally recognize five groups of elephants that have existed during the earth's history. Today, only the Indian elephant and the African elephant remain alive. (See Fig.1.)

The most important data used in tracing the history of the elephant are the size and structure of fossil teeth. Teeth can be used to estimate the sizes of the animals, as well as their diets. Tooth structures also give scientists hints about the kinds of chewing motions used by each kind of fossil elephant. This, in turn, indicates how the jawbones were attached to the skull. Knowledge of diets can also give scientists a clue to the ecology of the regions from which the fossil came.

In this investigation, you will use some data from the fossil teeth of elephants from the last seven million years. From these data, you will construct a "family tree." Although many features of teeth could be used, you will use only one: the number of plates (folds of enamel filled with dentine) on the lower third molar tooth. (See Fig. 2.) This is one of the most important features of an elephant's tooth. It is related to the volume of food that can be ground up in a single chewing stroke.

OBJECTIVE

- To understand one of the methods used by scientists to determine the relationship between the members of a group of organisms.

MATERIALS

coloured pencils

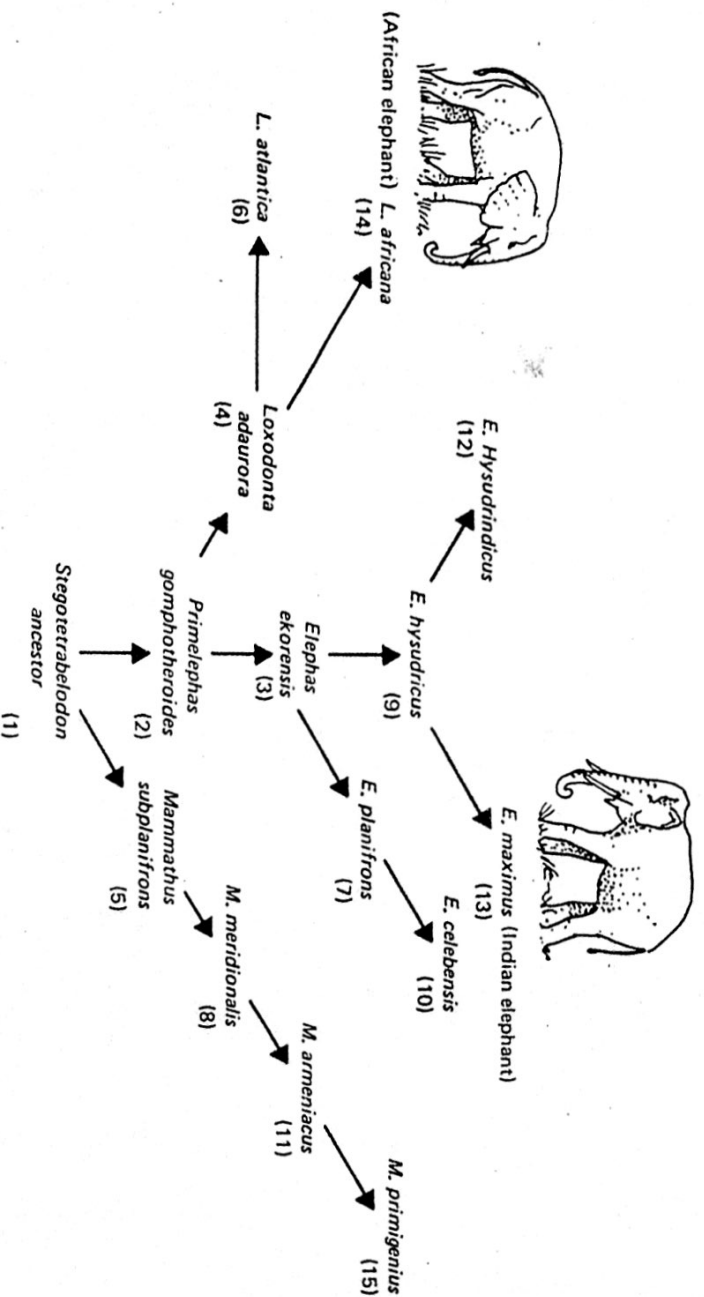


Fig. 1. Probable history of the elephants. Pictured species exist today.

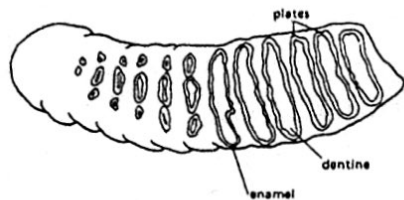


Fig.2. Chewing surface of an elephant molar showing the arrangement of plates.

PROCEDURE

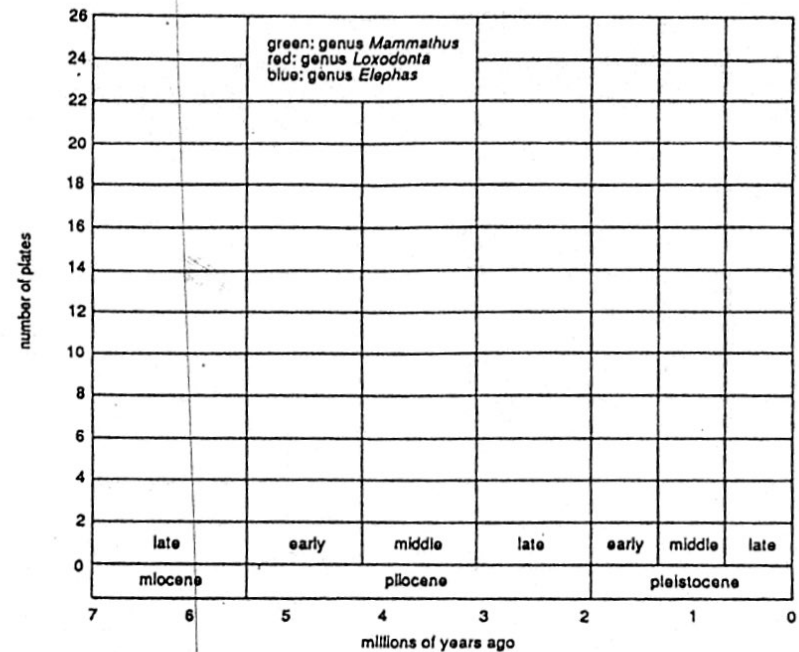
1. Plot the data from Table 1 on a graph like the one provided. Place the number of the species next to its point. Plot each point, except the first, in the centre of its time period. For example, place the point representing *Elephas ekorensis* in the Middle Pliocene, halfway between the lines separating it from the Early Pliocene and the Late Pliocene. Number this point 3.

2. Connect the numbered points as indicated by Fig.1. Use a red pencil to connect points representing the genus *Loxodonta*. Use blue for *Elephas*. Use green for *Mammathus*. For example, you will draw a red line from 4, *Loxodonta adaurora*, to 6, *L. atlantica*. You will draw a separate red line from 4 to 14, *L. africana*, because Fig.1. shows that *L. atlantica* and *L. africana* both descended directly from *L. adaurora*.

Table 1 Number of Plates in the Lower Third Molar of Fossil Elephants

Elephant Species	Time of Existence	Mean Number of Plates
1. <i>Stegotrabelodon ancestor</i>	7 million years BP*	6.5
2. <i>Primelephas gomphotheroides</i>	Early Pliocene	7.5
3. <i>Elephas ekorensis</i>	Middle Pliocene	12.0
4. <i>Loxodonta adaurora</i>	Middle Pliocene	10.1
5. <i>Mammathus subplanifrons</i>	Middle Pliocene	7.5
6. <i>L. atlantica</i>	Late Pliocene	13.4
	Early Pleistocene	14.0
	Middle Pleistocene	12.0
7. <i>E. planifrons</i>	Late Pliocene	10.1
	Early Pleistocene	10.3
8. <i>M. meridionalis</i>	Late Pliocene	11.0
	Early Pleistocene	12.9
	Middle Pleistocene	14.0
9. <i>E. hysudricus</i>	Early Pleistocene	13.7
10. <i>E. celebensis</i>	Early Pleistocene	11.0
11. <i>M. armeniacus</i>	Middle Pleistocene	18.3
12. <i>E. hysudrindicus</i>	Late Pleistocene	18.0
13. <i>E. maximus</i>	Late Pleistocene	23.0
14. <i>L. africana</i>	Late Pleistocene	13.3
15. <i>M. primigenius</i>	Late Pleistocene	21.8

* Before Present



Evolution of the lower third molar in the family Elephantidae

DISCUSSION QUESTIONS

1. What seems to have been the general trend of the number of plates in the third molar of fossil elephants?
2. There should be no vertical lines on your graph. Explain.
3. Is it possible to draw a single line on the graph that represents a single line of descent for the elephants? Explain.
4. Is there any evidence to suggest that the trend of an increased plate number can be reversed? Explain.
5. What was the average rate of increase in number of plates from *Primelephas* to *Elephas maximus* per million years?
6. What factor or factors do you think favoured the increase in the number of plates among the elephants from the Miocene to the Pleistocene?
7. At several points in the Pleistocene, various lines of elephants apparently became extinct. Suggest factors that might have caused this.