Name:_____

GEOL 104 Dinosaurs: A Natural History

Smithsonian Assignment II: Mesozoic Marine Life and the Cenozoic Era

DUE: December 3

The Smithsonian Institution's National Museum of Natural History (NMNH) has one of the largest collections of dinosaur and other fossils in the world. This exercise will concentrate on the wonderful dinosaur fossils on exhibit.

The Smithsonian museums are free; hours for the NMNH are 10 am to 5:30 pm 7 days a week. You can take the Metro from the College Park Station to any of a number of stations near the Museum. The quickest route is the Green Line from the UMd-College Park Station to Archives/Navy Memorial: you don't have to change trains, and the NMNH is just on the other side of the Archives Building.

For this exercise you may wish to bring along the dinosaur cladograms handed out in class. You may work in teams and discuss your answers; however **ALL WORK YOU TURN IN MUST BE YOUR OWN**. To comply with University Senate regulations, please sign the following so that you may receive credit for this assignment.

I pledge on my honor that I have not given or received any unauthorized assistance on this assignment

_____

Signature UID Date

This package works as sort of a self-guided tour. It will start you at the Mesozoic section of the Life in the Ancient Seas Hall, and then take you into the Hall of Fossil Mammals and Hall of Ice Age Mammals to get a glimpse at life after the Age of the Dinosaurs.

Some things to keep in mind:

- Remember proper handwritten taxonomic grammar:
  - **Genera** have one-word, capitalized, and underlined names:
    - Examples: Giganotosaurus Brachiosaurus
  - **Species** have ***two-word***, underlined names; the first part of the name (which is the same as the genus name) is capitalized, but the second part of the name is not:
    - Examples: Giganotosaurus carolinii Brachiosaurus altithorax
- When given a choice of items in bracket, **circle** the appropriate answer.

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PART I – MESOZOIC MARINE LIFE

Find the Hall of Ancient Life in the Seas, and make your way to the Mesozoic fossils (that is, go underneath the sign labeled "Act Two – The Mesozoic Era"). This hall as a whole documents marine vertebrate, invertebrate, and plant life throughout the last 542 million years with fossils, a great mural, and some life restoration models hanging about. The particular section you are in contains exhibits on the marine life of the Age of Dinosaurs.

Find the Mesozoic marine reptiles. These are mounted in front of or directly below the mural (and a few are in glass cases along the rail).

1) You can see a skeleton of the giant Cretaceous sea turtle *Protostega*. What features of its anatomy show that it was a sea turtle (as opposed to a land-dwelling one)? (List one, with extra credit for another).

2) Several partial skulls of placodonts are available. What evidence is there that placodonts ate shellfish?

3) Find one of the ichthyosaur skeletons. What evidence is there that ichthyosaurs would be unable to come up onto land?

4) There is a skeleton of a plesiosaur on display. Which species is represented?

5) Where was the plesiosaur in question 4 discovered?

6) The flightless marine bird *Hesperornis* (one of the few marine dinosaurs of the Cretaceous) is also on display. Which is larger, it's wings or its legs?

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7) The beak of *Hesperornis* differs from modern birds in a very important way. What feature is present in *Hesperornis*' beak that is not found in living bird species?

8) Several species of mosasaurs (true marine lizards) are on display. Which species does the largest specimen represent?

9) Where was the specimen of mosasaur in question 8 discovered?

The seas of the Mesozoic, like those of today, had diverse types of "shellfish" (invertebrates). Many examples are on display: some along the wall with the main mural, others in the center "island", and still others on their own display labeled "Taking Cover" on the wall opposite from the main mural.

In the center island, facing the marine reptiles, is an exhibit about ammonites (extinct relatives of the modern octopi, squids, and nautili.)

Some ammonites have straight shells, many have shells coiled in a disc, still others have more complex coiling patterns.

10) List a species of simply coiled ammonite (coiled in a single plane, like a Frisbee or donut):

11) List a species of straight-shelled ammonite:

12) List a species of ammonite with a more complex shell (i.e., not simply circular or not simply in a single plane):

Find the display labeled "Taking Cover". On the top of this section are many excellent fossils, such as several enormous ammonites and specimen of the scallop-relative *Inoceramus*.

13) The *Inoceramus* shown here is approximately the size of [a quarter | a dinner plate | a welcome mat].

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PART II – LIFE AFTER THE AGE OF DINOSAURS

Now you'll be heading to the fossil mammal halls. Move down the Hall of Ancient Life in the Seas into the next section ("Act Three – The Cenozoic Era"), and take a right up the steps labeled "Reptiles: Masters of the Land". On the wall opposite those steps is a small exhibit on the Cretaceous-Tertiary impact and extinction. This exhibit includes a real deep-sea drilling core that actually contains the stratigraphic boundary from the Cretaceous Period to the "Tertiary Period." (We technically call this the "Paleogene Period" now.)

14) Where was this particular deep-sea drilling core recovered?

The display shows electron micrographs of the microfossils and other features found in this core. In particular, it shows the foraminifera (single-celled organisms with a calcareous shell) from above and below the impact layer.

15) According to this display, the foraminifera immediately **after** the impact are best described as

[more diverse, more ornate, larger | less diverse, less ornate, smaller] than the ones before the impact.

From this Cretaceous-Tertiary exhibit, turn left. Turn right (the only option), and then turn left again. You should be facing the entrance to the Hall of Fossil Mammals, with a sign labeled "Mammals in the Limelight".

Find the wonderful mounted skeleton of *Hyracotherium vasacciensis*.

16) To what modern group of animals is *Hyracotherium vasacciensis* most closely related?

Now head over to the start of the hall, past the "Plants in the Age of Mammals" display, to a glass case display of Mesozoic mammals. In general, as you follow the Hall of Fossil Mammals along you proceed upwards in time, tracing the history of North American mammals, other animals, and their environments through the Cenozoic Era. Each exhibit is organized by Epochs. Cenozoic Epoch names are different from those in the rest of geologic time: instead of being in the form "Late Jurassic Epoch" or "Early Permian Epoch", each is given a unique name. From oldest to youngest, they are the Paleocene, Eocene, Oligocene, Miocene, Pliocene, Pleistocene, and Holocene (or

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Recent). The last two Epochs are part of the Quaternary Period, and have a hall of their own (the Hall of Ice Age Mammals). The rest are the old "Tertiary Period," (now broken into the Paleogene and Neogene Periods) and represent the exhibits in the main Hall of Fossil Mammals.

Compare the actual fossils (not the enlarged white models) of Mesozoic mammals with those of the Paleocene mammals.

17) Does there seem to be a size change from the Mesozoic to the Paleocene? If so, what change occurred?

18) What part of the body is most represented in the Paleocene mammals on display here?

The rest of the Tertiary is organized with a series of paintings in the back and the actual fossils and casts of fossils arrayed in front. Start with the Eocene exhibit.

In the glass cases are many specimens from the Green River Shale, a famous fossil locality. Many types of organisms have been recovered from these rocks. Indicate a species (remember, a **two-word italicized name!**) of each of the following that is represented by Green River Shale fossils on display here:

19) Bird: _____

20) Fish: _____

21) Plant: _____

22) The biggest animal in the main Eocene display is *Uintatherium*, a horned quadrupedal herbivorous mammal. What feature of the dentition (teeth) of *Uintatherium* appears to be unusual for a typical plant-eater?

23) Does it appear that *Uintatherium* could feed relatively high in trees (the way that sauropods and hadrosaurids could)? Why or why not?

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Continue along the Eocene display. Rank the following animals in size (by “Largest”, “Medium”, and “Smallest”):

24) *Diatryma* (a bird):

25) *Smilodectes* (a primate):

26) *Hyrachyus* (a rhinoceros-relative):

Move on to the “Oligocene” Epoch exhibits (which are actually mostly latest Eocene Epoch mammals, by more recent geologic time studies).

27) *Brontotherium hatcheri* is the largest animal on display here. It was a

[bipedal carnivore | quadrupedal carnivore | bipedal herbivore | quadrupedal herbivore].

Extra Credit) There are several non-avian reptile fossils in the Oligocene exhibit. List the species name of two, each for extra credit.

Head on over to the Miocene Epoch exhibit.

28) *Moropus* possessed powerful claws on its forelimbs. It was a [herbivore | carnivore].

29) A section of a bone bed (a mass accumulation of fossils) is shown at the Miocene exhibit. What mammals represent the majority of bones in this bone bed?

Stop over at the evolution of the horse exhibit “Evolution: Browsers to Grazers”. (Incidentally, the Smithsonian has an excellent collection of fossil horses). Over the history of equids (horses) many aspects of their anatomy change. They represent one of our best records of **correlated progression**. List at least two major different trends in horse evolution, with extra credit for a third trend.

30) Trend 1:

31) Trend 2:

Extra Credit)

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Look at the Late Miocene-Early Pliocene Epoch display. The largest mammal here is *Stegomastodon*.

32) To what **living** animal group is *Stegomastodon* most closely related?

[rhinos | horses | elephants | humans | hippos]

33) What evidence can you see that the rhinoceratoid *Teleoceras fossiger* was not a fast running animal?

Move into the Hall of Ice Age Mammals. As you enter, there is an exhibit of some odd mammals off to your left.

34) What "common" (that is, English) name is given to the giant mammal *Eremotherium*?

Extra Credit) What was its diet?

35) Just as the dinosaurs produced the ankylosaurs, so too the mammals produced their own heavily armored forms: the glyptodonts. On display is the glyptodont *Glyptotherium arizonae*. What is this animal's likely diet?

36) In what major functional way was the shell of *Glyptotherium* and other glyptodonts different from that of their modern cousins, the armadillos (also on display)?

Turn around, and look at the fossils from Rancho La Brea (the famous La Brea Tar Pits) in the exhibit "Fossils and Tar Pits". There are two species of carnivorous mammal here, threatening the ground sloth *Paramylodon.*

Give the ***species name*** for carnivorous mammals on display:

37) Dire wolf:

38) Sabre-toothed cat:

Extra Credit) How do these Ice Age predators compare in size to *Tyrannosaurus rex*?

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39) To what group of animals does *Teratornis merriami* belong?

40) According to the display, what is the likely explanation that so many carnivorous animals are found in the tar pits?

Further down in the Ice Age Mammal Hall are fossils of northern mammals. The two largest of these shown here are *Mammuthus primigenius* (the wooly mammoth) and *Mammut americanum* (the mastodon).

41) Where was this skeleton of *Mammuthus primigenius* found?

Go to the skeleton of *Mammut*. In front of it are the teeth of *Mammut* and *Mammuthus* that you can touch.

42) The teeth of [the mastodon *Mammut* | the mammoth *Mammuthus*] were better adapted for chewing, while the other one was better adapted for grazing and grinding.

Find the "mummy" of the extinct bison *Bison crassicornus* on display.

43) In dinosaur "mummies" the actual skin is not preserved, only the impression of the skin. In the case of this bison, however, this is the honest-to-goodness skin and flesh. How was this soft tissue preserved in Nature? (That is, how is it that there is still dried skin and flesh on these bones?)

Consider that the animals in the main section of this hall were living in North America when humans first entered the continent 13,000 years ago (in some cases, they actually arrived at the same time). Just a short time ago (geologically speaking), America's wildlife was at least as spectacular as that of the modern Serengeti Plain.

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There are some non-American fossil animals on display in this room, in a rotunda. Find these, and indicate where in the world each of the following animals was from:

44) *Megaloceros*: 45) *Diprotodon*: 46) *Dinornis*:

Extra Credit) Which of those three was a dinosaur?

That's it for this trip! While you are in the museum, use your time to examine some of the other exhibits.