# Playing Paleotopia

## The Paleontology Learning Game for Grades 5-7

**By Gerald Marino, Matt McNerney & Susan Connell**

## Instructional Objective

It will reinforce the principle that fossils have recorded a record of life on earth and help them relate and match fossils of specific life forms to information known about those life forms. Variations and the use of a time line can also help students understand which life forms lived during specific prehistoric periods.

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## Learners & Context of Use

This game is designed for late middle school (grades 5-6) and early junior high school (grade 7) students studying earth science, life science and evolution. At this point they study the principles of rock stratification, that the fossil record tells a story of the evolution of life on earth and that the composition of rocks and their fossils can be used to match rock strata from different locations. In addition they study how many groups of living things have changed over time, evolved and some have become extinct. Children of all ages are intrigued with ancient life forms and this game will help them make connections between the descriptions of these life forms and their actual images.

This game can be used in the classroom as an activity to help them connect their earth science and life science studies. It requires very little set up but teachers can set the stage by talking about paleontology and how paleontologists use what they find in the earth and relate that to what they know from their research. To help students develop critical thinking skills, after playing the game teachers can also discuss with students the kind of connections they made and what they were thinking when they matched specific images with the information they had on hand (in the Research cards.)

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## Object of the Game

You’re a paleontologist, searching the world for pre-historic remnants and evidence of past life. As you move through the landscape you’ll need to dig for discoveries (in the dig spaces) and research for information on what you dig up in your adventures (research spaces.) Your goal is to set out from the University in search of evidence of past life and return after you match 5 Dig Cards with their correct Research Card. Be the first to make it back to the University with your matches and you become the Paleontology Professor and game winner.

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## Game Materials

- 6+ Playing Pieces
- 6-Sided Die or Spinner
- 25+ Bone Pile Cards
- 50 Dig Cards and corresponding Research Cards
- Research and Dig Card Matching Key
- Game Board

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## Time Required

You can play the game on a timed basis of 45-60 minutes or until the first player returns with 5 matched cards. If the game is timed, at the end of the time limit the player with the most matched cards wins.

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## Setup

Print out game pieces, game board, Bone Pile Cards, and TWO copies of the Research Cards and Dig Cards from the Paleotopia PDF file. You will need a copy of Adobe Acrobat Reader (available free at www.adobe.com), version 5 or later to properly print the files. The Game Board is larger than standard letter sized paper so you will need to select the “Tile Oversized Pages” option in the Adobe Acrobat print menu.

Lay the board out and divide the Dig cards in 5 equal stacks, face up so you can see the plants and animals on each card. Place the Research cards, face down, in a single stack and do the same for the Bone Pile cards.

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## The Rules

Starting at the University, roll the die to see who goes first. The first player rolls the die and moves the number of spaces indicated on the die. Players can take any route they want in one of 4 directions—up, down, right and left but cannot occupy a space twice on the same roll. You cannot move diagonally (from the corners of a square) and must go around any space another player occupies. You cannot move through or occupy any brown squares.

As you move around the board and land on a Research space take a card with a description of a prehistoric plant or animal on it. When you land on a Dig space you can take your choice of any of the top cards in one of the 5 stacks. You cannot collect a Dig or Research card on successive turns from the same space. If you land on a Bone Pile square you must draw a Bone Pile card and follow the directions. Once you have followed the directions on the card return that card to the bottom of the Bone Pile deck.

The goal is to match the Dig card with its matching Research Card. When you get 5 matching cards (or when the time limit is reached for the end of the game if you are playing a timed game) maneuver back to the University. First one back to the University with their matched cards becomes the Paleontology Professor and wins the game. If the game is timed, the player with the most cards at the end of the game wins.

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## Design Process

We started the process by trying to create a game to go with a Paleontology video we were developing for another project. We wanted to create a game that would help players associate plants and animals with the type of landscapes and geological formations found in ancient time periods. We also wanted to create a game that would give players a sense of the issues involved in a paleo dig.

We reviewed Cardboard Cognition (http://edweb.sdsu.edu/courses/edtec670/Cardboard/BoardTOC.html), searched the Internet and went to a few teacher store and game stores looking for similar games. We were also referred to archeology game and activity sites. We found one game (Dino Dig) that was a paleontology game focused on teaching dinosaur facts.

We wanted the game to encompass more information than dinosaurs and wanted to help students make inferences and connections rather than merely teach facts. We worked through the game design process found at (http://edweb.sdsu.edu/Courses/EDTEC670/boardgame/BoardGameDesign1.html) individually and then compared notes. We reworked the concept several times, and reworked the board design to align the structure of the game with the content we wanted to convey.

We showed this idea to friends, family and Professor Bernie Dodge for feedback. Bernie's feedback made us go back to the drawing board to redesign the board and rework the rules.

On "Beta Test" night at ET 670 we observed others play and evaluate the game and made several changes. We initially had the Dig cards in one pile but noticed that players made more inferences if they read the research cards and then looked for plants and animals that matched the description. We decided to place the Dig cards face up in 5 stacks so players could choose. The game could also be played the other way, with the Dig cards face down in one stack and the Research Cards face up in 5 stacks and let players match the information to the image, rather than the image to the information.)

We also changed several other items. We originally had names and time periods on both the Dig and Research Cards. We took the names off the images so students would have to match information and images rather than just names.

We noticed that players tended to stay in the middle of the board and move around the spaces there. We added spaces on the edges of the board that they are directed to by the Bone Pile cards. This will move them out around the board so they don't cluster in the middle. Originally there was only a single set of the Dig and corresponding Research cards but we realized that if an opponent took a card that a player had a match to, that would preclude either from making a match so we created duplicate Dig and Research cards to prevent this. (A variation of the game could be played by allowing players to trade cards and thus make matches quicker.)

We learned how hard it is to create a board game that aligns content with the structure of the game. We also learned to be more flexible at the beginning of the game design process so we don't paint ourselves into a corner. In addition our future games will probably not have as much content as this one. We discovered how hard it is to research for content and then place the content on game cards.

# Variations

**Variation A**
Instead of the setup listed above, place the Research cards in 5 stacks, face up and the Dig cards face down in one stack. When players land on a Research space they can choose any of the face up research cards. This will allow them to match an image with its information rather than vice versa and create a different type of inference and deduction to properly match their cards.

**Variation B**
As part of a unit on prehistoric discoveries, earth science or evolution, post a timeline of paleontologic eras on a wall. As students create matches they pin or tape the cards to the appropriate era so they can see the types of life forms that lived during that time. This should further help them make connections to what they are studying about the geologic and paleontologic eras they are studying because they will see the shapes and types of plants of those eras gradually build as they pin their cards on the timeline.

**Extend the Game**
To extend the game to specific time periods or units of study the teacher or students can create more cards specific to the unit of study.

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# References


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**Electronic**

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Images from www.clipart.com and http://www.photos.com

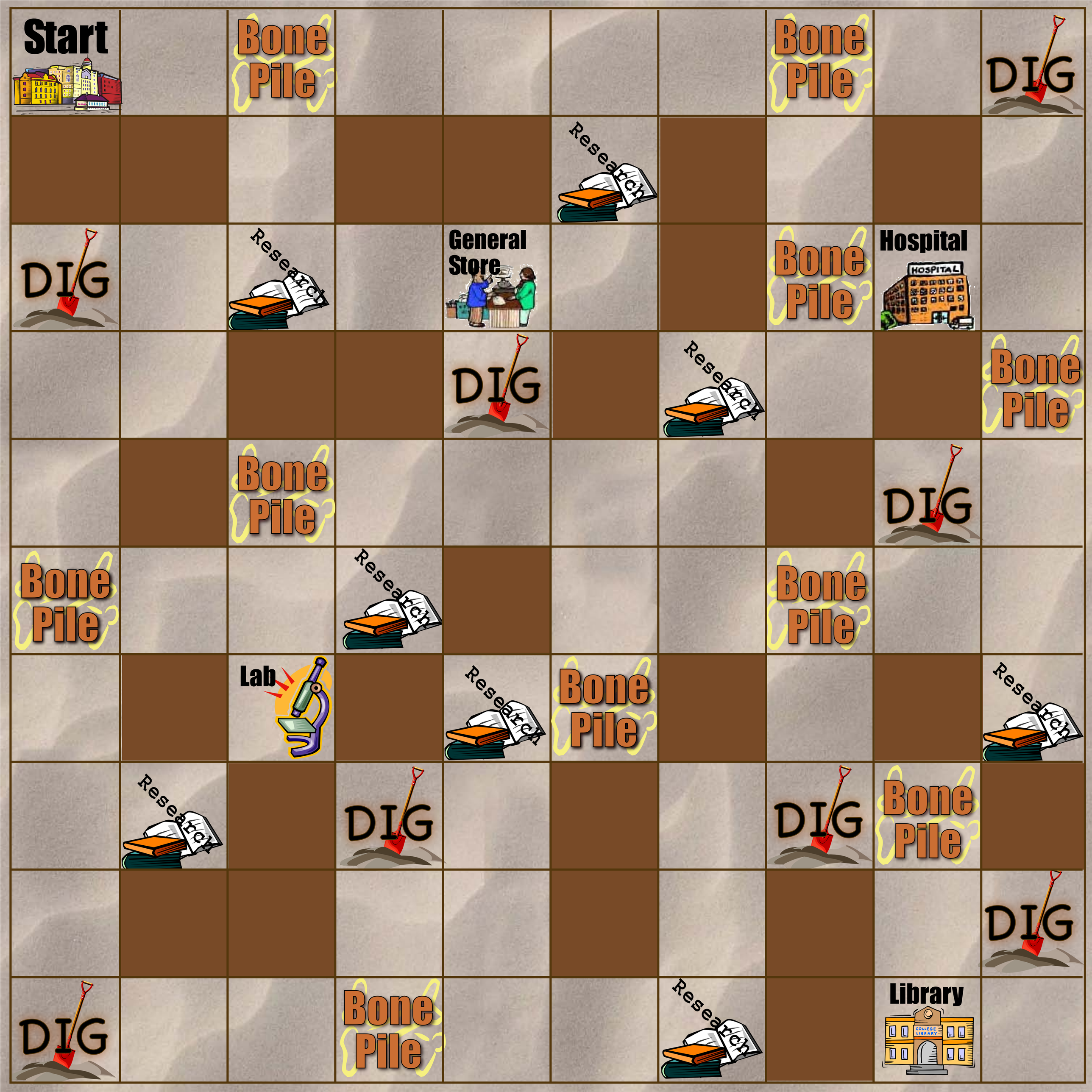
# Paleotopia Key

Use this key to verify matches between Dig Cards and Research Cards.

| Dig Card | Research Card |
|---|---|
| **Dig # 25** | None — Bottle Cap |
| **Dig # 24** | Ordovician Graptolites |
| **Dig # 23** | Pleistocene to 1800 AD, Dinornis Maximus |
| **Dig # 22** | Miocene, Platybelodon, (shovel tusker) |
| **Dig # 21** | None — Ceramic Glass |
| **Dig # 20** | Jurassic, Eryma, (arthropod) |
| **Dig # 19** | Miocene, Tetrabelodon, (long-jawed mastodon) |
| **Dig # 18** | Devonian-Silurian, Oldhamia, (Early fern) |
| **Dig # 17** | Devonian, Fern tree |
| **Dig # 16** | Horse foot evolution from the Eocene to the Pleistocene |
| **Dig # 15** | Cambrian, Trilobite |
| **Dig # 14** | Silurian Calymene blumenbachii |
| **Dig # 13** | Late Cretaceous, Hadrosaur |
| **Dig # 12** | Cretaceous, Corythosaurus, (crested dinosaur) |
| **Dig # 11** | Cretaceous, Ichthyornis |
| **Dig # 10** | Devonian, Heliophyllum, (coral) |
| **Dig # 9** | Permian, Ophiacodon |
| **Dig # 8** | Permian, Glossopteris |
| **Dig # 7** | Permian, Conifer |
| **Dig # 6** | Dugong, (ancient jawless fish) |
| **Dig # 5** | Devonian, Arthrodires, (fish with bony armor plating) |
| **Dig # 4** | Pennsylvanian, cephalopod |
| **Dig # 3** | Cambrian Fossils |
| **Dig # 2** | Jurassic, Archaeopteryx |
| **Dig # 1** | Late Jurassic, Stegosaurus |

# Game Marker Pieces

Glue to Cardboard, cut out individual squares and use
to mark each player's position on the board.


Start
Bone Pile
Bone Pile
DIG
Research
DIG
Research
General Store
Bone Pile
Hospital
HOSPITAL
DIG
Research
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DIG
Bone Pile
Research
Bone Pile
Lab
Research
Bone Pile
Research
Research
DIG
DIG
Bone Pile
DIG
DIG
Bone Pile
Research
Library
COLLEGE LIBRARY

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS





FOLD

Grant proposal awards more funding. Roll again.

Grant proposal awards more funding. Roll again.

Grant proposal awards more funding. Roll again.

Federal Historic Preservation Fund awards 3 year grant. Roll again.

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS





FOLD

Book publisher buys rights to your next book. Roll again.

You are granted tenure at the University. Roll again.

One of your papers is published. Draw a Research card.

An eccentric old man arrives via helicopter and offers to fund your dig for another 3 years. Draw a Research card.

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS





FOLD

Car company donates new hybrid SUV. Draw a Research card.

You're running out of supplies. Go to the general store to stock up.

You're running low on funds. Lose a dig card. (return a Dig card to the top of a dig deck)

You're running low on funds. Lose a dig card. (return a Dig card to the top of a dig deck)

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS





FOLD

One of your research assistants joins the Peace Corps. Give up a research card (return Research card to top of a Research deck)

One of your dig staff is bitten by a snake. Give up a research card (return Research card to top of a Research deck)

New university dean revokes partial funding. (return Research card to top of a Research deck)

Bad weather delays excavation. Lose a turn

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS





FOLD

Uncover unusual fossil specimen. Go to the library to research.

Uncover unusual fossil specimen. Go to the lab for detailed examination.

Good weather quickens excavation Move 1 square in any direction

Excavation cancelled due to Bad weather Go to the lab for more research.

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS





FOLD

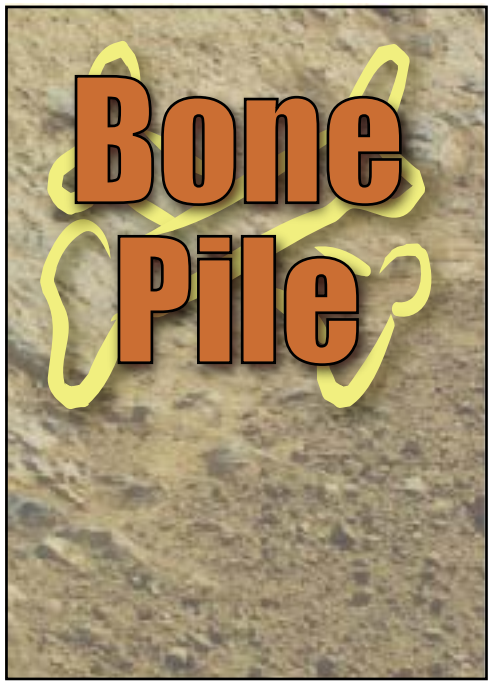
You are diagnosed with heat stroke. Go directly to the hospital.

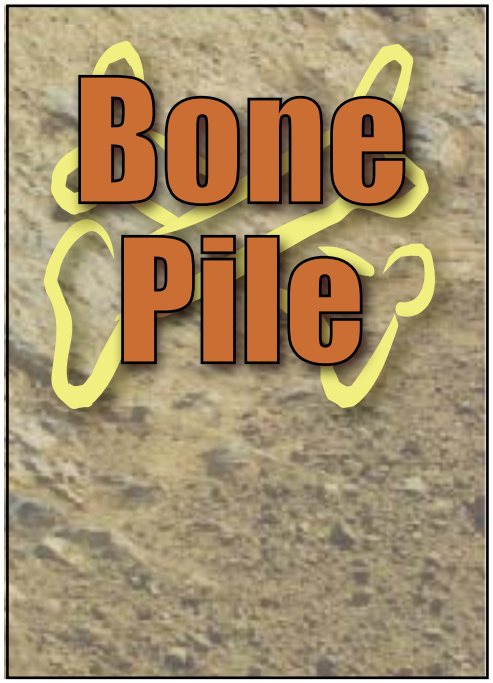
Bank loan allows you to hire more workers. Move 2 squares in any direction.

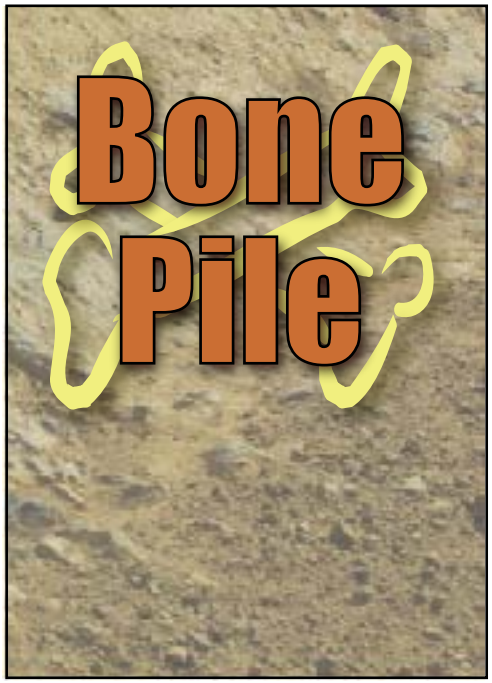
Local paleontology club donates excavation tools. Move to the nearest Dig square.

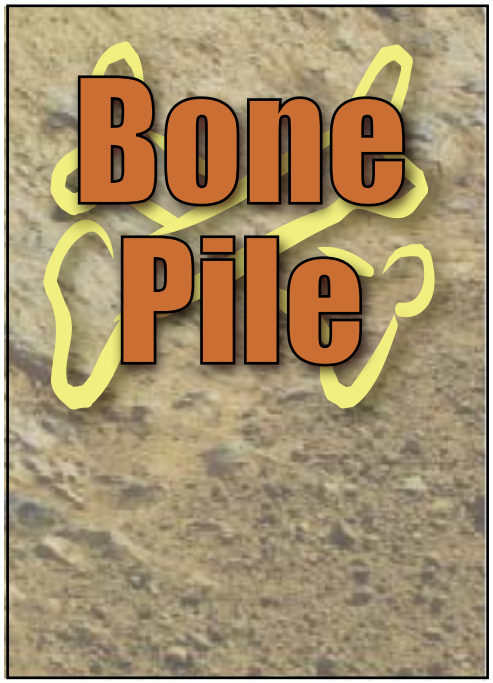
You are hired to consult for a movie about dinosaurs. Move to the nearest Research square.

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS




FOLD

University establishes $1 Million dollar endowment fund. Move 3 squares in any direction.

Lose grant funding. Go back to the University.(start)

Establish partnership with United States Geological Survey. Move 3 squares in any direction.

Shovel breaks. Go to General Store.

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Late Jurassic**
**Stegosaurus**

A very large dinosaur of the late Jurassic period, this animal was a herbivore and had 17 bony plates embedded in its back.

## DIG #1

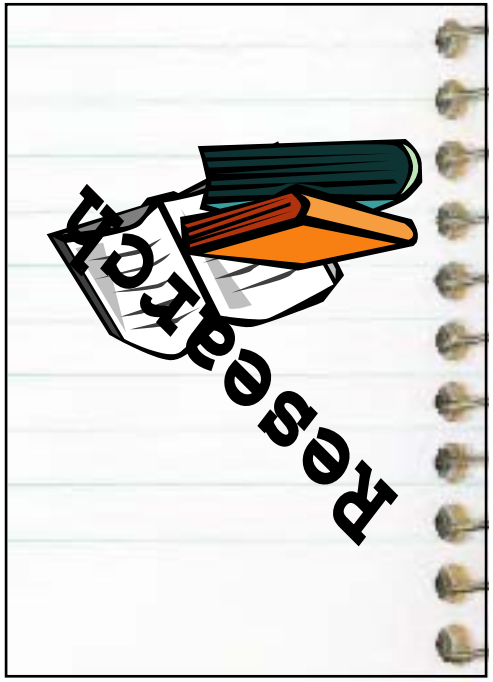
## Research

**Jurassic**
**Archaeopteryx**

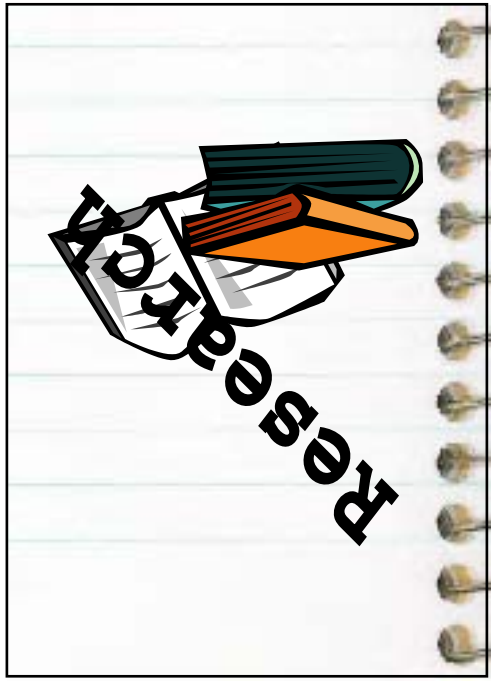
Although this is considered the earliest bird, it had reptilian features. The fact that it had feathers and a tail leads paleontologists to believe that this animal gives evidence to the belief that birds evolved from reptiles.

## DIG #2

FOLD








FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Cambrian Fossils**

Most fossils from the Cambrian Period consisted of a variety of marine invertebrates including "shelly" fauna

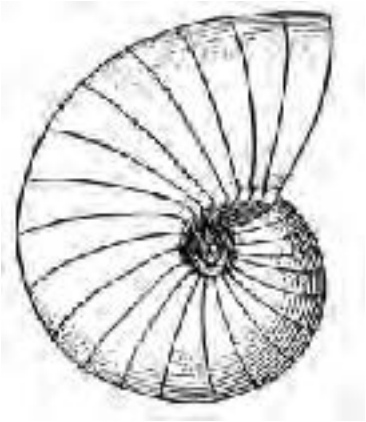
## DIG #3

## Research

**Pennsylvanian cephalopod**

This mollusk was a predator in ancient oceans and is now extinct. It is related to the modern day nautilus and squid.

## DIG #4



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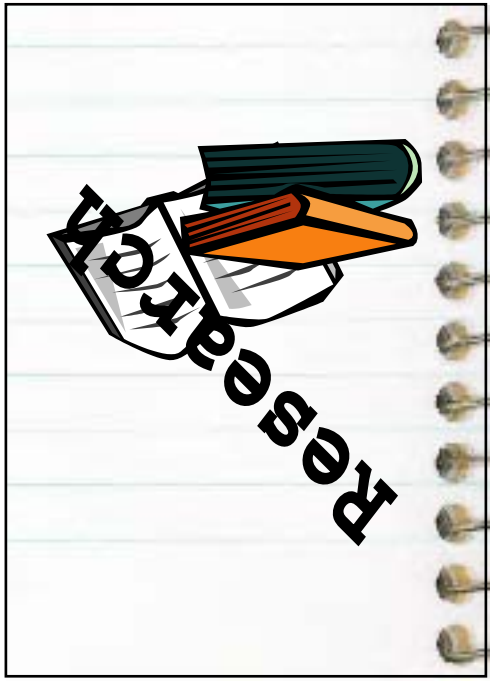


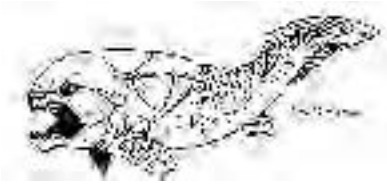

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Devonian**
**Arthrodires**
(fish with bony armor plating)

This fish of the Devonian period grew to more than 20 feet in length and had thick bony armor plating around its head.

## DIG #5



## Research

**dugong**
**(ancient jawless fish)**

This ancient jawless fish is related to today's manatee and sea cow.

## DIG #6

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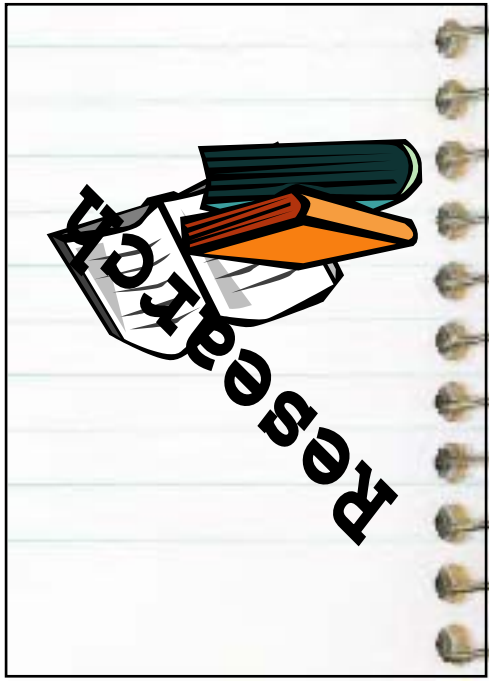




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## Research

**Permian Conifer**

Conifer trees became prominent in the Permian period.

## DIG #7

## Research

**Permian Glossopteris**

Fossils of this tongue shaped seed have been found throughout India, South America, southern Africa, Australia, and Antarctica. Because it has been found in so many places throughout the southern hemisphere it has led scientists to deduce that there had once been a land bridge between these areas.

## DIG #8

FOLD




FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Permian**
**Ophiacodon**

A four legged reptile with short, sprawling, clawed legs, a long tail, and large jaws in a narrow but large skull. It was a meat eater, up to about 12 feet long and lived near water.

## DIG #9

## Research

**Devonian**
**Heliophyllum**
(coral)

This coral flourished during the Devonian when the earth was warm with a green house effect and covered with oceans.

## DIG #10

FOLD




FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Cretaceous**
**Ichthyornis**

This ancient bird had a large head, toothed jaws, and long beak. It is the oldest-known bird that had a keeled breastbone (sternum) similar to that of modern birds.

## DIG #11

## Research

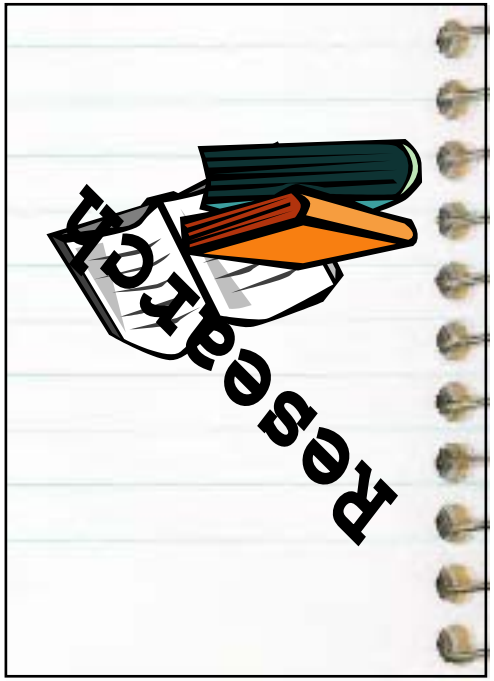
**Cretaceous**
**Corythosaurus**
(crested dinosaur)

A 30 ft long duck-billed dinosaur with a crested head. It ate plants and lived in the late Cretaceous period.

## DIG #12

FOLD






FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Late Cretaceous Hadrosaur**

A member of the duck-billed ornithopods which grew to a large size, possessing a shovel-type mouth. This group of fossil reptiles have the honor of being the first dinosaurs excavated in the United States and lived during Late Cretaceous times.

## DIG #13

## Research

**Silurian Calymene blumenbachii**

This relative of the trilobite was commonly found in Central England more than 400 million years ago. It was a sluggish swimmer and probably walked around the sea floor scavanging for food.

## DIG #14

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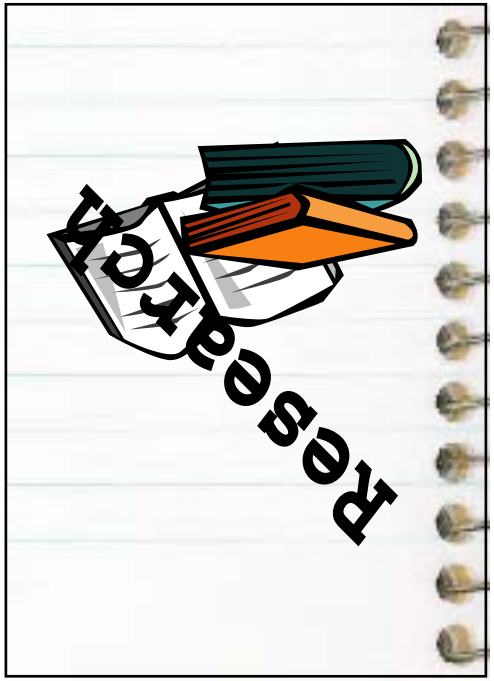


FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Cambrian Trilobite**

Early invertebrates with a segmented body and an exoskeleton (external). They were one of the dominant life forms of their era.

## DIG #15

## Research

**Horse foot evolution from the Eocene to the Pleistocene**

The evolution of the horses' hoof went from the four-toed Eohippus of the Eocene, the three functioinal toes of Mesohippus of the Oligocene, the reduced side toes of the Miocene Hipparion , and the modern one toed horse in the Pliocene-Pleistocene eras.

## DIG #16


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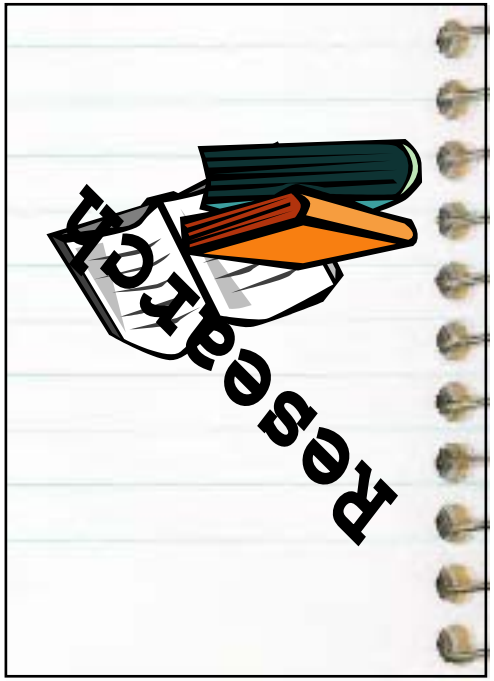


FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Devonian**
**Fern tree**

This early plant of the Devonian era was unique in that, although classified as a fern, it had both wood and fern-like reproduction.

## DIG #17

## Research

**Devonian-Silurian**
**Oldhamia**
(Early fern)

An early fern of the Silurian-Devonian periods it is unusual in that it had a central stem and “radiating branches”.

## DIG #18

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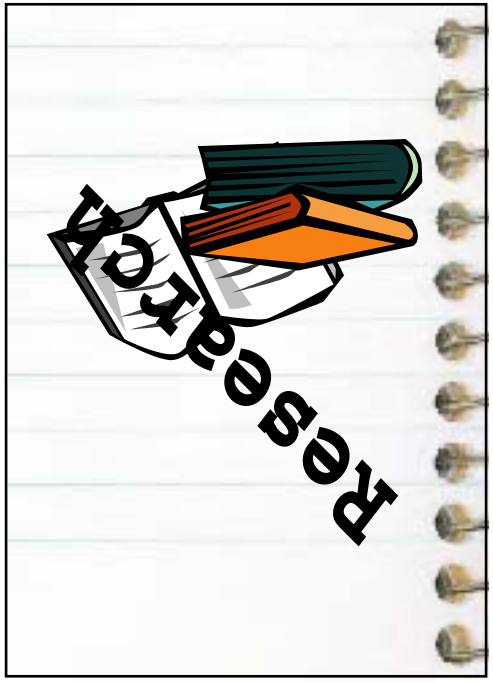




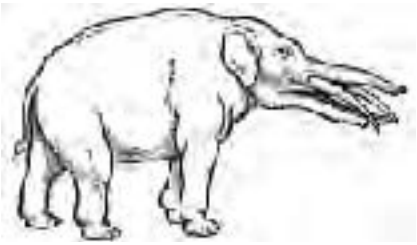

FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Miocene**
**Tetrabelodon**
(long-jawed mastodon)

This four-tusked elephant ancestor was an early mastodon of the Miocene period.

## DIG #19



## Research

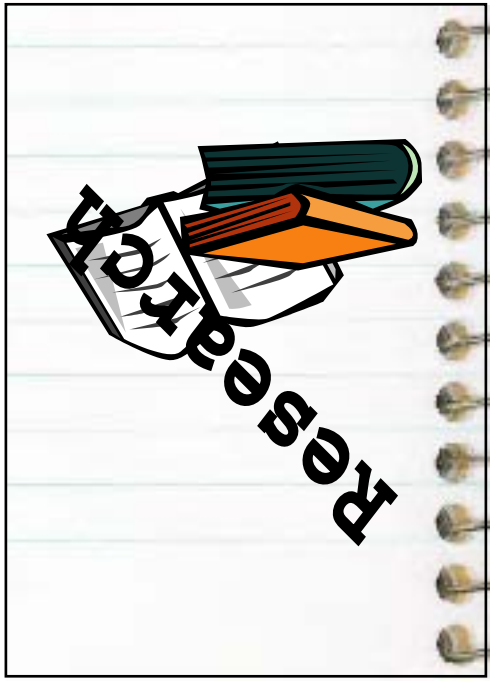
**Jurassic**
**Eryma**
(arthropod)

An arthropod of the Jurassic period this creature is an ancestor of modern lobsters.

## DIG #20

FOLD






FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

# DIG #25


It's an old bottle cap, but not prehistoric..

# DIG #21

Sorry, just a piece of ceramic tile mixed up in the dig.

# Research

**Miocene**
**Platybelodon**
(shovel tusker)

This elephant ancestor lived about 25 million years ago and was know as a “shovel tusker”.

# DIG #22

FOLD




FOLD ON DASHED LINE AND THEN CUT BETWEEN CARDS

## Research

**Pleistocene to 1800 AD**
**Dinornis Maximus**

This flightless bird was the tallest bird that ever lived and could grow to 11 1/2 ft tall. It was slow-moving herbivore, ate seeds and fruit and swallowed stones that helped digest the food.

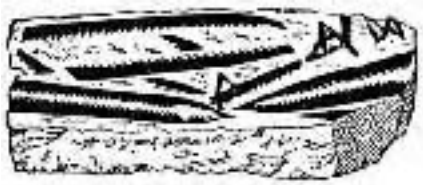
## DIG #23

## Research

**Ordovician**
**Graptolites**

Graptolites (literal translation "writing on rock") are most often found as thin carbonized films in shale or limestone.

## DIG #24



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