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Paleobotany

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Introduction

Paleobotany is the study of fossilized plant material, and includes the study of fossilized spores and pollen. Many plants during the Pennsylvanian Period were fossilized during coal formation in permineralized peat deposits, forming coal balls. Coal balls contian numerous fossils of plant fragments, including pollen and spores that are preserved in meticulous detail.

The tools and processes required for the study of microfossils in coal balls are inexpensive and can be found in most high school laboratories. Two methods of coal ball study will be described in this paper. The first method involves the study of microfossils through the preparation of microscope slides and the second method involves the making of coal peels. Both methods necessitate the procurement of coal balls for study. Coal balls may be obtained from coal mines, from discarded specimens at universities, or purchased from Ward's Natural Science Establishment.

Preparation of Slides

The following procedure is suggested for making microfossil slides from material preserved in coal balls:

1. Cut a coal ball in half to expose an inner surface.
2. Select an area on the cut surface for study. Take some modeling clay and form a plug 2-3 cm long which is 4 cm in diameter at one end (the top) and tapers to 2-3 cm at the bottom. Place the plug over the area to be studied.
3. Make a reservoir around the plug by forming a wall of clay 3 cm distant from the plug (see Fig. 1).

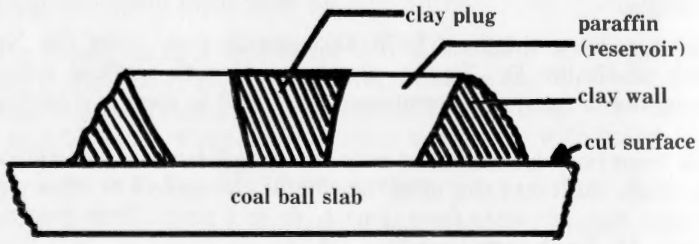

Fig. 1. Cross-section of a coal ball slab.

4. Fill the reservoir with melted paraffin and allow the paraffin to solidify. When the paraffin has solidified remove the clay plug, which forms a well (see Fig. 2).
5. Fill the well with a 10% solution of HCl and leave in place for 10 minutes.

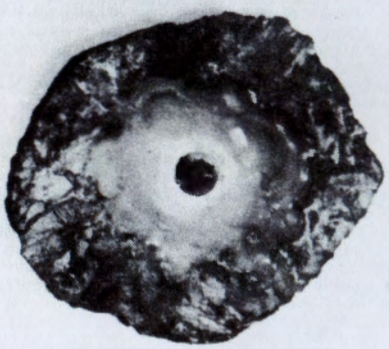

Fig. 2. The well formed when the clay plug is removed.

6. Pipette off the fossil-containing fluid and centrifuge for 5 minutes.
7. After centrifuging, decant the acid and soak the fossils in a dehydration series as outlined in Table 1. After each fluid change centrifuge the new fluid.
8. Following the last soaking in xylene, the microfossils may then be mounted on microscope slides in a resinous medium such as picolyte and covered with a No. 0 coverslip.
9. Allow the slide to dry for one week before study.

Table I

Dehydration Series

Dehydrating fluid	Time
50% ethanol/50% water	*2-4 hrs.*
95% ethanol	*4 hrs.*
95% ethanol	*6 hrs.*
absolute alcohol	*6 hrs.*
50% absolute alcohol/50% xylene	*4 hrs.*
100% xylene	*4 hrs.*
100% xylene	*4 hrs.*

The identification of microfossils can be assisted by using the references at the end of this article. With time it becomes easy to separate

spores and pollen from other plant fragments. With further practice it is possible to identify pollen as to genera and species.

Coal Peels

The second method of studying coal balls involves making a coal peel. In this method, one embeds a 30-40 micron layer of fossil peat in a layer of cellulose acetate as follows:

1. Cut a coal ball into 3 cm thick slabs. If a lapidary saw is unavailable contact a lapidary shop or department of geology for assistance. (Coal balls purchased from Ward's Natural Science Establishment come precut.)
2. Grind the cut slab on a thick glass plate (Fig. 3) smeared with a paste of water and No. 400 grit carborundum powder. Use a circular or figure eight motion to grind the specimen until it is smooth to the touch. Rinse the grinding paste off with water and allow the slab to dry.

Fig. 3. A paste of carborundum powder is placed on a glass plate and the coal slab is rubbed until smooth.

3. After drying, place the ground face in a 5% HCl bath for about 15 seconds. This will dissolve the minerals from the coal ball and leave the fossilized organic matter unharmed. The precise immersion time will vary from slice to slice and must be determined by trial and error. After etching, the slab must be rinsed in water for a few minutes to remove traces of acid.
4. Place the slab in a "gravel pit" (Fig. 4) etched side up and allow to dry thoroughly.
5. When the surface is absolutely dry, coat half of the coal ball with acetone applied with a wash bottle. A sheet of cellulose acetate is gently rolled on the slab from the acteone end to the dry end (Fig. 5). This eliminates excess acetone and assures a good peel.

6. Dry the slab from 1-6 hrs. The cellulose acetate sheet may then be peeled off and mounted on cardboard for study (Fig. 6).

Fig. 4. A coal ball slice placed in a bed of gravel prior to making a peel.

Several peels may be taken from a single slab by repeating the above procedure for each peel made. The slab should be reground (Fig. 3.) for each peel. When all peels have been taken, the slab should be protected by leaving one peel in place during storage.

Fig. 5. A cellulose acetate sheet rolled onto a slab. Only half of the slab is covered with acetone as the rolling action of the sheet will serve to spread the acetone over the slab.

Items most commonly found during the study of peels are plant fragments of stems or bark, petioles or reproductive structures. Consult the references at the end of this article for identification guides.

Conclusion

Though the topic of paleobotany may appear complex, it is not beyond the abilities of second year students and can provoke many interesting discussions concerning the flora of prehistoric earth.

Fig. 6. Several peels taken from a single slab and mounted on cardboard sheets.

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