

Technical

MAKING SOIL MONOLITHS

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Soil monoliths mounted with plastic are useful for display purposes and as teaching aids. This publication outlines the methods and materials used by many pedologists in Canada for collecting the soil and for preparing the finished monolith in the laboratory.

COLLECTING THE SOIL

Expose the soil profile to be sampled in a bank or pit. Before digging a pit, place a board on the surface of the soil to protect the surface during digging. Dig the pit about 3 ft wide, 3 ft long, and 3 ft deep. (Most Canadian soils are less than 3 ft deep, but some profiles need to be sampled to a greater depth.) Throw the excavated soil on the side of the hole opposite the sampling site.

Trim the exposed face and roots with a sharp shovel or a large knife to make a plane surface (Fig. 1).

The next step depends on the type of box to be used. One type is a wooden box having inside dimensions 36 x 4 x 2 inches and fastened together with screws to facilitate dismantling at the laboratory. Another type consists of pieces of 2 x 1/8-inch angle iron, welded at the corners to make a frame, and a detachable backing board fastened to the frame by bolts. The soil-cutting edge is sharpened. A third type is made of 16-gauge galvanized iron fastened with screws to a wooden board (Fig. 6).

If a wooden box is to be used, mark vertical parallel lines 4 inches apart with a knife and a straightedge from the soil surface to the bottom of the pit. Then cut the soil at right angles and remove it from the sides of the marked column to leave sharp right-angled corners on the column. Remove the soil to a horizontal depth of about 3 inches (Fig. 1). Next scribe a horizontal line on the face of the soil column at a depth of 3 ft from the soil surface. Then carefully cut into the column to remove the soil below the mark in the same way as for the sides.

Push the wooden box firmly but gently over the column (Fig. 2). Pack soil under the bottom of the box to prevent the column and box from settling during the next step.

When using a metal box, press the metal frame or box into the soil bank until it is flush with the soil. Screw jacks are very useful for this task (Fig. 3 and 4).



Fig. 1. The trimmed column of soil is ready to be fitted into the wooden box.



Fig. 2. The wooden box is carefully placed over the column of soil.



Fig. 3. The angle-iron frame without its backing board is forced into the soil by means of three screw jacks.



Fig. 4. When the backing board is in place, the soil is dug away from the sides and back of the column.

Next, cut between the bank and the box (Fig. 4). A large butcher knife is best for this work, but sometimes a shovel, hand trowel, or coarse sawblade may help. As the soil is dug away wrap the box with sacking or rags to prevent the soil from falling out of it. When you come near the bottom of the box, support it to prevent the column from breaking away prematurely. After severing the column, tilt the box backward and lift it out of the pit and lay it flat on the ground. Trim off the excess soil, making the surface level with the edges of the box. A large butcher knife or a coarse file is suitable for this job (Fig. 5).



Fig. 5. Excess soil is removed from the monolith.

PREPARING MONOLITHS IN THE LABORATORY

To fix a monolith on a display board, impregnate the soil with resin dissolved in organic solvents. The materials required are vinyl acetate — vinyl chloride copolymer, grade VYHH, in powdered form; technical grade acetone; and methyl isobutyl ketone.

To prepare the resin solutions, place some solvent in a large-mouth screw-top bottle, insert a magnetic stirring bar, place the bottle on the stirrer, and adjust the speed to create a deep vortex in the solution. Add the resin slowly in batches. Keep the screw top on the bottle to minimize the loss of solvent.

The monolith should be air-dry before proceeding.

Prepare a mounting board of ½-inch plywood 6 inches wide and 36 inches long. Outline with a pencil the desired position of the soil on the board. Coat the outlined area with 20% resin in acetone (20 g resin in 100 ml acetone) (Fig. 7).

If the trimmed surface of the soil is rough, place a layer of cheesecloth on it. Pour 20% resin in acetone on the soil or cheesecloth until the surface is covered (Fig. 6 and 7).

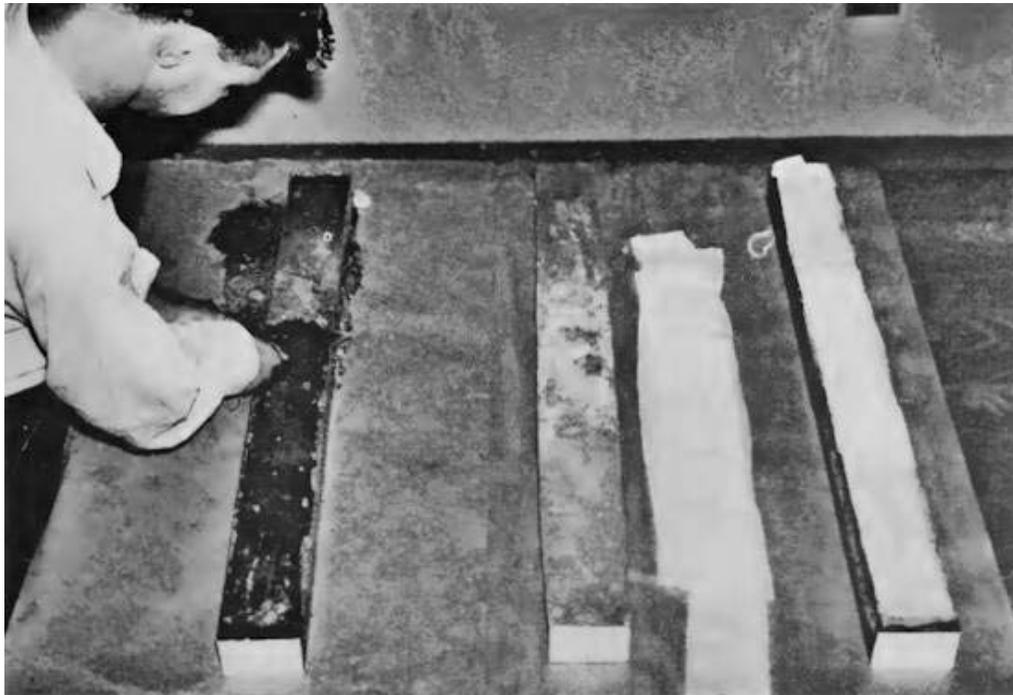


Fig. 6. At left, the soil is trimmed flush with the edge of the box. The monolith in the center is ready for the next step. The one on the right is covered with strips of cheesecloth.

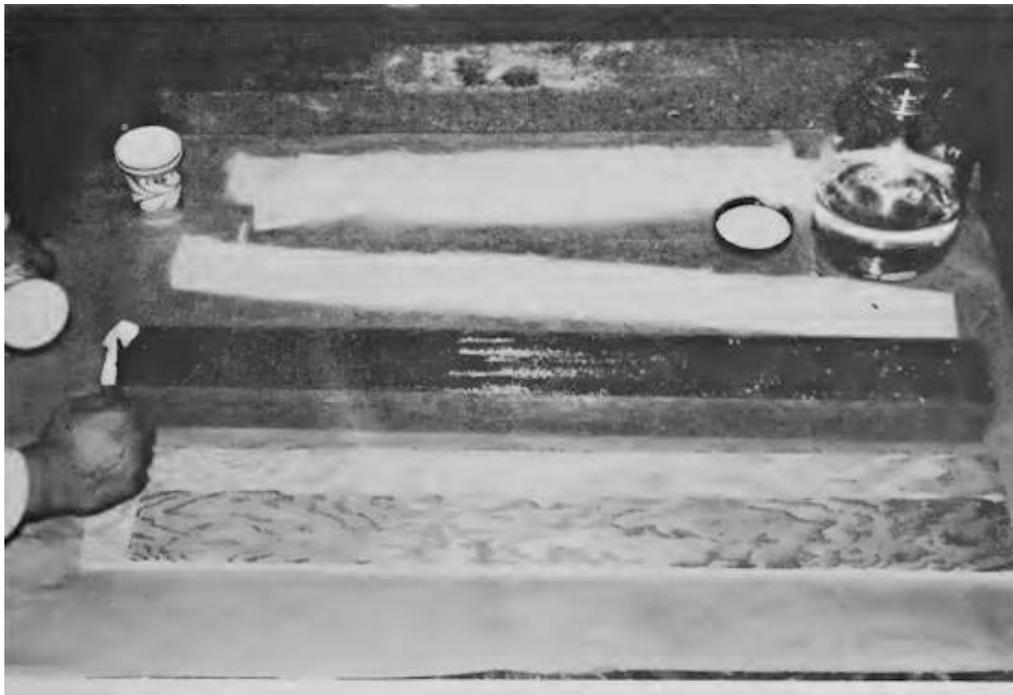


Fig. 7. The mounting board and soil surface are coated with 20% resin in acetone.

Place the treated side of the board on top of the soil monolith. Then, while holding the board and the box together, invert the board and the box. Remove the box gently, taking care not to break the monolith. Take away the loose soil that falls on the board when the box is removed and set the monolith aside overnight to allow the resin to harden (Fig. 8).



Fig. 8. The sheet-metal box has been removed and the monolith is on the resin-coated board.

Remove the soil from the surface of the monolith to show the natural soil structure and to make the monolith as thin as is feasible. Since most soils are softer when moist, sprinkle the soil with water. Starting at the upper end of the monolith, loosen the soil with a thin narrow knife blade or a thin pick and remove the loosened material with a vacuum cleaner hose (Fig. 9). Pick the soil from the top to the bottom of the monolith; this ensures that the marks made by the knife blade are removed when the next section of soil is picked. Cut the roots and root hairs with a sharp knife or scissors. Be sure to pick the soil in such a way that the natural soil structure is displayed. Do not cut through the natural structural units, but remove material from between the structural planes to give depth to the structures. After completing the picking, set the monolith aside to dry.

The next step is to impregnate the monolith with resin so that it will be hard and well cemented to the mounting board. The success of the operation depends on adjusting the concentration of the resin solution to suit the porosity of the soil.



Fig. 9. Loosened soil is removed with a vacuum cleaner.

Pour a trickle of resin solution over the soil until the whole soil mass is thoroughly wet (Fig. 10). For most soils the best solution is 10% resin in acetone—ketone solution (10 g resin in 50 ml acetone plus 50 ml methyl isobutyl ketone). If the soil is fine textured and impermeable, use a 5% resin in acetone—ketone solution (5 g resin in 50 ml acetone plus 50 ml ketone). Allow the resin-coated soil to become dry and hard. Then pour on more resin solution as long as it will soak in; if free solution remains on the surface the finished monolith will be shiny. Do not spray the solution onto the soil because this promotes surface drying and shallow penetration.

When the soil is thoroughly cemented, inspect the edges and be sure that the soil is well bonded to the mounting board. If there are concavities between the soil and the mounting board, poke small pieces of cheesecloth into them and squirt 20% resin solution (20 g resin in 100 ml acetone) into the cracks with a pressure-type oilcan; be very careful not to put any of this solution on the treated soil surface because it will make it very shiny. A shiny soil surface sometimes can be corrected by washing with methyl isobutyl ketone.

It may be necessary to trim stones that protrude at the edges. If the stones are small, use a dry diamond-edged lapidary saw. When cutting large stones, cool the saw with water. Clean up the face and edges of the mounting board and paint them with a neutral-gray latex paint that approximates N 6.5/0 in the Munsell system of color notation. Attach an identification label to the top of the board.



Fig. 10. The resin solution is poured onto the soil surface.

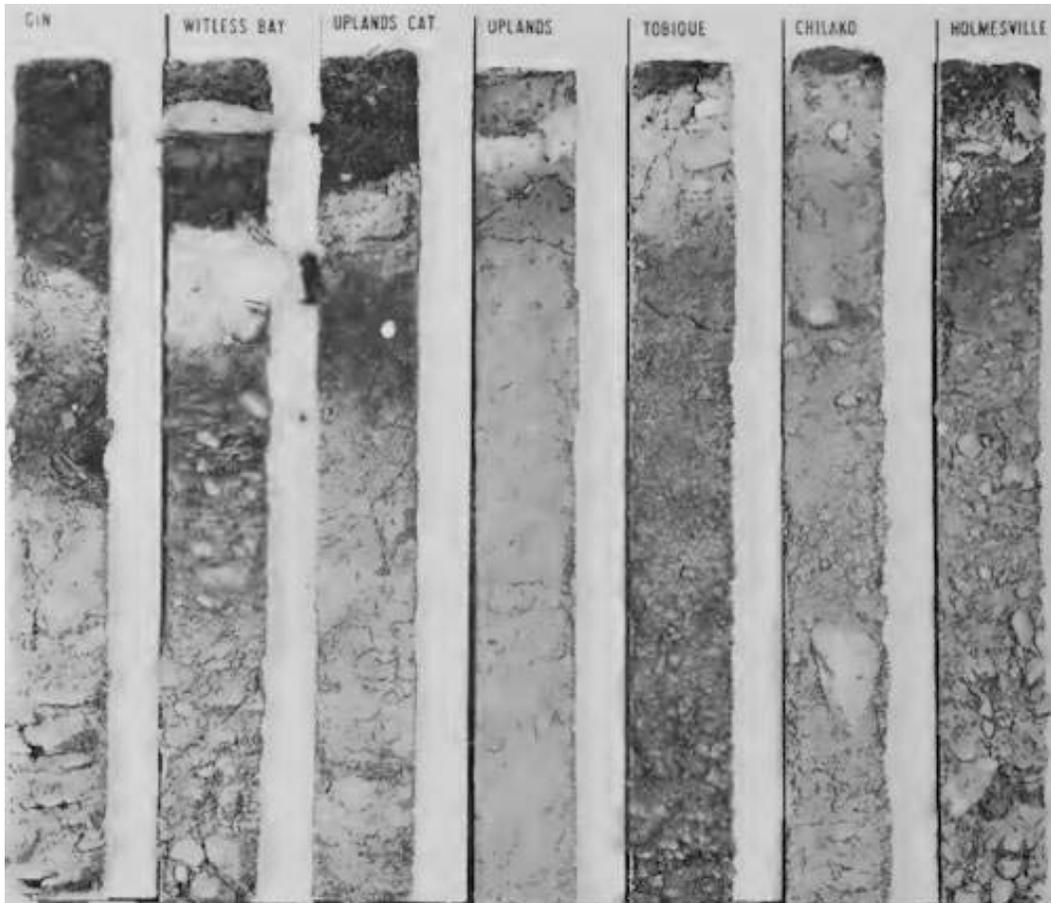


Fig. 11. A group of finished soil monoliths.

ACKNOWLEDGMENTS

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