

Procedures for Preparation of Soil Monoliths
Revised Edition

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INTRODUCTION

Soil monoliths give very useful aids for teaching and extension, demonstration purpose, and comparative studies in soil science. Soil profiles may be taken from the fields and preserved as soil columns or as soil peels which are more realistic than color photographs, drawings or paintings.

Soil monoliths were first collected in Russia during the last decades of the 19th century. Soil profiles from Russia were displayed at the Columbian Exhibition in Chicago in 1893-1894, on the occasion of an international exhibition. Eighteen large monoliths from Latvia were on display at the First International Congress of Soil Science, Washington 1927. These soil profiles were collected in iron or wooden boxes.

Preservation of soil profiles with an adhesive was introduced by Schlacht in 1928. After that, although various newly developed chemicals were applied for the impregnation of soil material, nitrocellulose lacquers, vinylight (vinylacetate-vinylchloride copolymer) resin and polyvinyl acetate emulsion are now universally used.

On the other hand, Buried Cultural Properties Center, National Nara Cultural Properties Institute developed Tomack NR-51 (special epoxy resin) and Tomack NS-10 (special urethane resin) for the profile transcription of the buried ruins.

Epoxy resin is characterized by strong adhesive ability, low contractiveness and absence of organic solvent. Urethane resin is characterized by hardening with water and high plasticity.

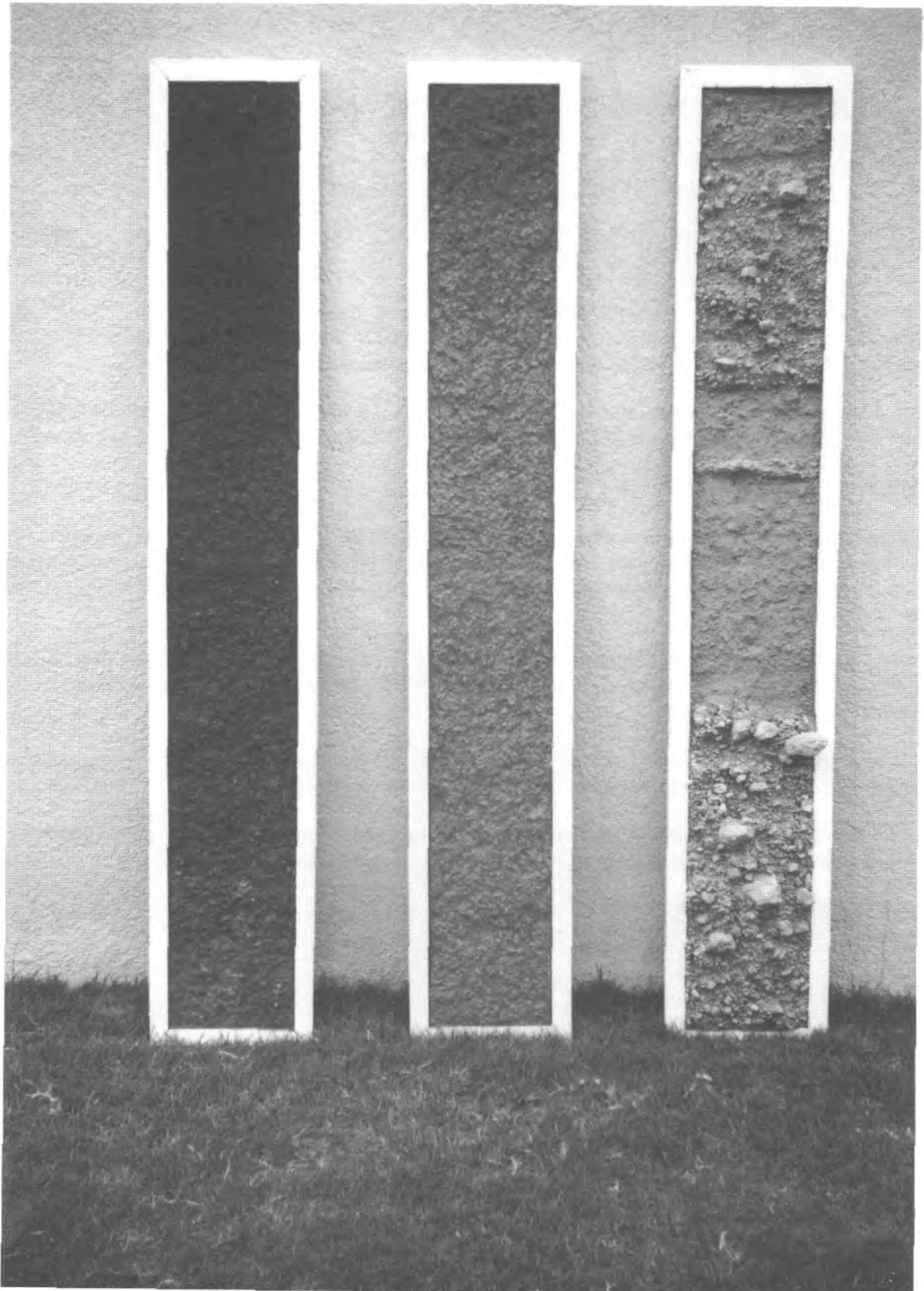
This manual includes the procedures for the preparation of soil column monoliths using wooden boxes and soil peel monoliths using epoxy resin or urethane resin, and polyvinyl acetate emulsion.

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Soil peel monoliths
Hapludoll from Tagaytay, Cavite, the Philippines (Left)
Kandiudult from Tanay, Rizal, the Philippines (Center)
Lahar deposits from Bamban, Tarlac, the Philippines (Right)

1. TAKING A SOIL COLUMN MONOLITH IN THE FIELD

1.1 Tools and materials

Tools for digging and exposing soil profiles

Shovel
Crowbar
Hatchet
Pruning shears
Hand shovel
Folding meter scale
Kitchen knife

Tools and materials for taking a soil column monolith (in addition to the above tools)

Wooden monolith box with lids screwed (Fig. 1)
Screwdriver

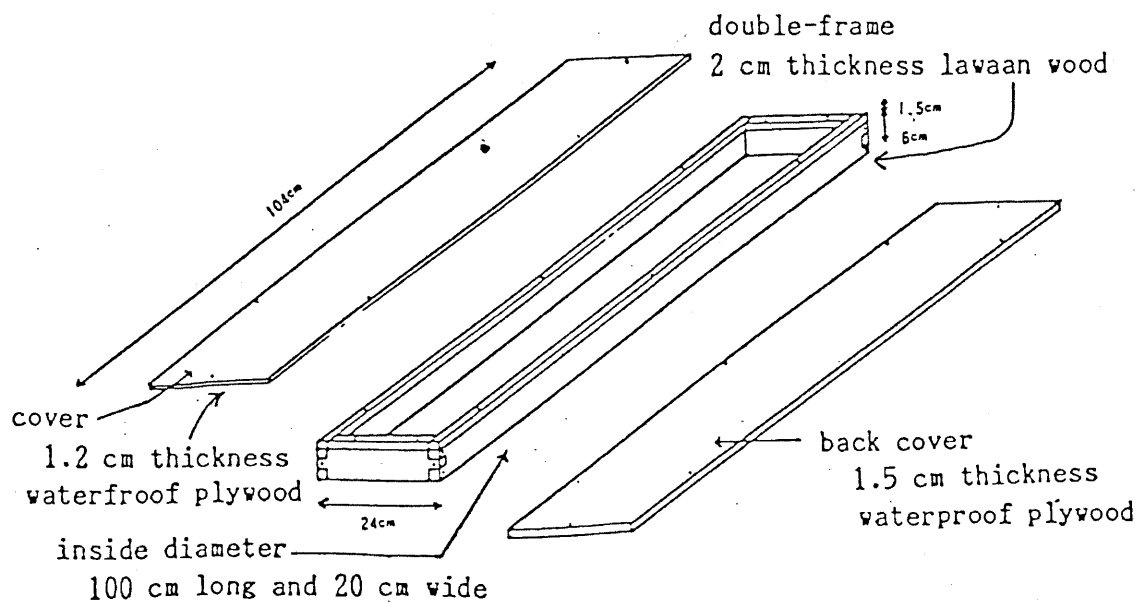


Fig. 1. A wooden monolith box with double frames.

1.2 Preparation of a pit

1) Dig a pit with shovel and crowbar. The pit should be about 1 meter wide, 1 to 2 meters long and at least 10 cm deeper than the actual depth of the profile to be collected in order to provide enough working space below.

2) Smooth one wall of the pit with a kitchen knife or a hand shovel (Photo 1).

1.3 Procedure

1) Mark the top and bottom portions of the monolith box with a marker pen.

2) Remove the lids of the monolith box. Do not lose the screws.

- 3) Mark the internal dimensions of the monolith box on the wall of the pit with a kitchen knife (Photo 2).
- 4) Cut the soil column at least 3 cm thicker than the thickness of the monolith box on the wall of the pit with a kitchen knife.
- 5) Carefully cut the soil column following the exact internal dimensions of the monolith box (Photo 3).
- 6) Push the monolith box over the soil column, properly placing the top and bottom portions (Photo 4).
- 7) Remove the excess soil materials on the surface of the monolith box by smoothing the profile (Photo 4).
- 8) Screw the first lid on the frame of the monolith box.
- 9) Remove the soil materials behind the box by a kitchen knife from both sides of the box. Cut exposed roots using pruning shears (Photo 5).
- 10) After cutting more than one third each of the joined part of the soil column from both sides of the box, push a shovel into the joined part (Photo 6).
- 11) After cutting roots, detach the monolith box from the wall of the pit (Photo 7).
- 12) Level the profile with a kitchen knife (Photo 8) and screw the second lid onto the frame of the monolith box.
- 13) Pack the monolith box and transport it to the laboratory for chemical treatment.

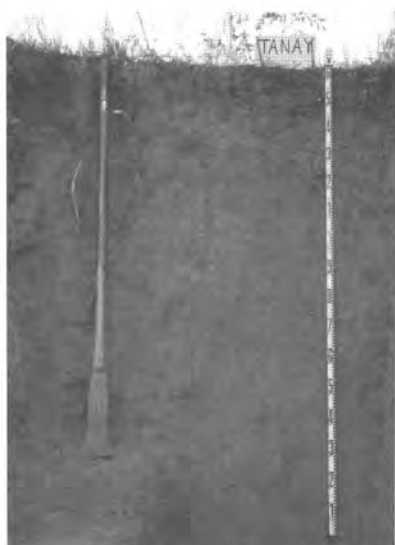


Photo 1. A pit is dug and one wall is smoothed.



Photo 3. A soil column which has the exact internal dimensions of the box is cut on the wall.



Photo 5. The soil materials behind the box are removed.



Photo 2. The internal dimensions of the monolith box are marked with a kitchen knife on the wall.



Photo 4. The box is pushed over the column.



Photo 6. A shovel is pushed into the joint part.



Photo 7. After cutting roots, the box is detached from the wall.



Photo 8. The profile is leveled.

2. PREPARATION OF A SOIL PEEL MONOLITH FROM A SOIL COLUMN MONOLITH

2.1 Tools and materials

Tools for cutting off and finishing off a soil peel

Kitchen knife
Knife
Pruning shears
Brush
Screwdriver
Saw
Cutter
Plywood board (5 mm thick) with the dimensions a little larger than that of the soil column monolith
Tweezers

Tools for applying and pouring resins

Can (2-4 L) with a handle for Tomack NR-51; or
Plastic vessel (1 L) with a handle for Tomack NS-10
Spray (500 mL) with water
Plastic vessel (1 L) with cap
Pipette (10 mL)
Stirring wooden rods
Wooden trowel for Tomack NR-51; or brush for Tomack NS-10

Resins

Bond CH18 for wood (Polyvinyl acetate emulsion), and
Tomack NR-51 (Epoxy synthetic resin) and Tomack NR-51-w (Hardener with plastic material for Tomack NR-51); or
Tomack NS10 (Urethane synthetic resin)

Materials

Cloth made of chemical synthetic fibers such as mosquito net
Mounting board (Fig. 2)

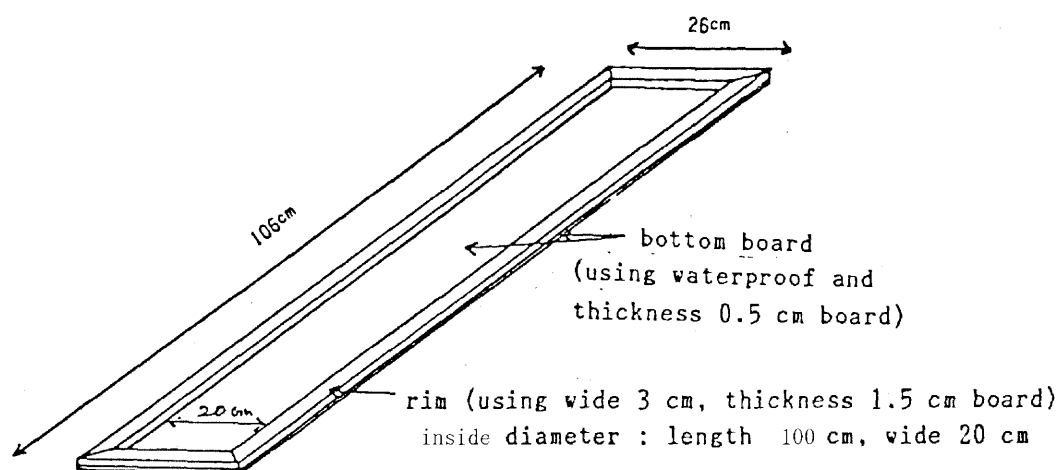


Fig. 2. A mounting board with frames.

2.2 Procedure

Pretreatment

1) Place the soil column monolith from the field on a working stand. Remove the lid of the thinner frame side of the monolith box.

2) Smooth the profile of the soil monolith with a kitchen knife. If the profile is very wet, drying it for several days, again smooth it (Photo 9).

Applying the Tomack resin

3) Put a piece of cloth 10 cm wider than the profile and pin it on the monolith box (Photo 10).

4) Mix 450 grams of Tomack NR-51 and 180 grams of hardener (Tomack NR-51-w) per 2000 cm² (20 x 100 cm) of the profile in a can. Stir it well. Or

Provide 450 mL of the Tomack NS10 per 2000 cm² (20 x100 cm) of the soil peel in plastic vessel (1 L) with a handle.

5) Uniformly apply the Tomack resin with a wooden trowel or a brush on the cloth, remove the pins, and turn up the cloth following the exact dimensions of the profile.

6) Apply the Tomack resin again on the cloth, and leave it overnight (for at least 4 hours) for Tomack NR-51 to harden (Photo 11) or spray water enough and then leave it for about one hour for Tomack NS10 until the Tomack NS10 resin hardens.

Cutting off

7) After hardening, remove the screws which connect two frames of the monolith box.

8) Cut off the soil peel with a saw holding with the plywood board (Photo 12).

9) Put the soil peel between two plywood boards and turn over.

10) Remove the upper plywood board, separate the frame bound with the resin from the soil peel with a cutter (Photo 13).

Mounting

11) Exactly make the soil peel to the same dimensions as the internal ones of the mounting board.

12) Mix 100 grams of Tomack NR-51 and 40 grams of hardener (Tomack NR-51-w) per 2000 cm² (20 x 100 cm) of the mounting board in a can, stir it and uniformly apply it on the mounting board with a wooden trowel; or

Uniformly apply Bond CH18 for wood (Polyvinyl acetate emulsion) on the mounting board with a wooden trowel

13) Slip the soil peel into the mounting board (Photo 14).

14) Roughly loose the surface of the soil peel with a knife. And repair it with the excess soil materials of the same horizon, if it has any damage.

15) Put the weights on the soil peel, and leave it for the night (at least 4 hours) for the Tomack NR-51 or for at least three days for the Bond CH18 for wood to fix on the mounting board.

Finishing

16) Carefully poke and loosen the surface of the soil peel with a knife to reveal the structure (Photo 15).

17) Dilute 100 grams of Bond CH18 for wood and about 2 mL of synthetic neutral detergent with 400 mL water in a 1 L vessel and stir it well.

18) Uniformly drop the diluted Bond CH18 on to the soil surface with a 10 mL pipette twice or three times and leave it until the soil peel dries (It will take two or three days) (Photo 16).

19) After drying, if the soil surface cracked, press the both sides of the cracks with a knife or tweezers dispersing the cracks. And drop the diluted Bond CH18 again on the soil surface once and leave it for two days.

20) Repeat step 19 once to three times until the soil materials are completely fixed on the mounting board.



Photo 9. After preparing the moist condition, the profile is smoothed



Photo 13. The bound frame is separated from the soil peel.



Photo 10. A piece of the cloth is put over the profile.



Photo 14. The peel is slipped into the mounting board.



Photo 11. The Tomack 51 resin is applied on the cloth



Photo 15. The surface of the peel is carefully poked and loosened to reveal the structure



Photo 12. After hardening, the soil peel is cut off.



Photo 16. The diluted Bond CH18 emulsion is drop on the peel.

3. DIRECT PREPARATION OF A SOIL PEEL MONOLITH

3.1 Tools and materials (Number is the number in Fig. 3 and 4.)

Tools for digging and exposing soil profiles, and cutting off a soil peel in the field

Shovel
Crowbar
Hatchet
Pruning shears ③
Hand shovel ②
Folding meter scale ⑬
Kitchen knife ④
Cutter ⑧
Plywood board (5 mm thick) with the dimensions a little larger than that of the soil peel to be cut off ⑱
10 nails (about 10 cm long)
Marker pen (fine) ⑩
Scantling (1.5-2.0 m long, 3 cm wide and 1.5 cm deep) for a rule ⑰

Tools for applying resins in the field

Plastic vessel (1 L) with a handle ⑭
Spray (500 mL) with water ⑫
Brush ⑥
Plastic gloves

Tools for finishing off a soil peel

Brush ⑤
Cutter ⑧
Knife
Pruning shears ③
Tweezers ⑩

Tools for applying and pouring resins in the room

Plastic vessel (1 L) with cap ①
Pipette (10 mL) ⑦
Stirring rods
Wooden trowel

Resins

Tomack NS-10 (Urethane synthetic resin) ⑯
Bond CH18 for wood (Polyvinyl acetate emulsion) ⑮

Materials

Cloth made of chemical synthetic fibers such as mosquito net ⑪
Packing material of soil peel
Mounting board (Fig. 2) ⑲

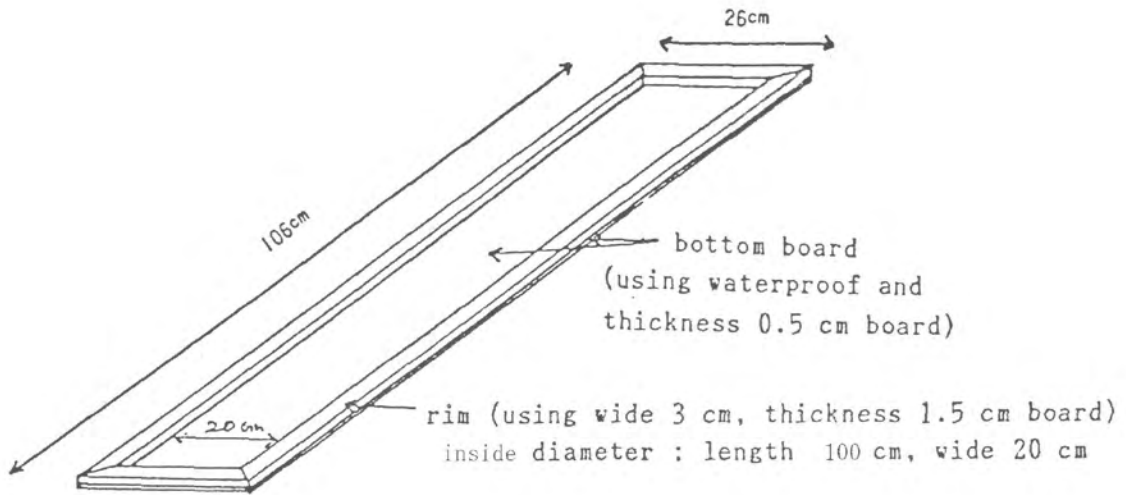


Fig. 2. A mounting board with frames.



Fig. 3. Tools, materials and resins

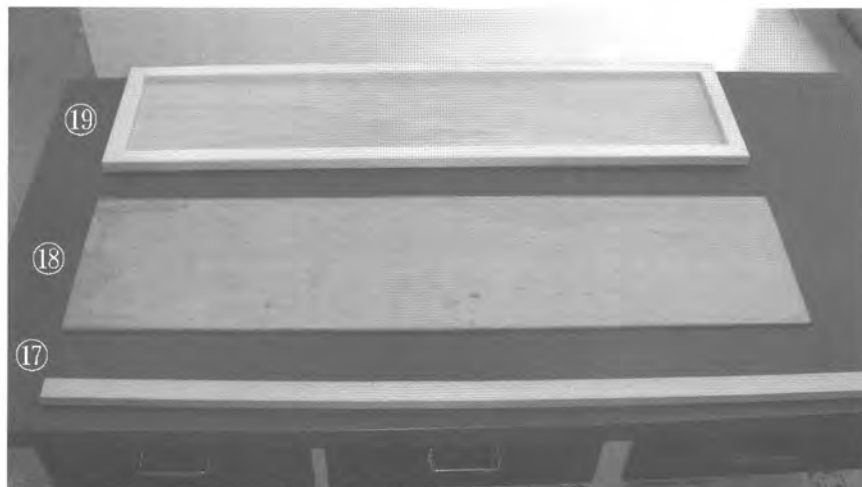


Fig. 4. Wooden materials

3.2 Preparation of a pit

1) Dig a pit with shovel and crowbar. The pit should be about 1 meter wide, 1 to 2 meters long and at least 10 cm deeper than the actual depth of the profile to be collected in order to provide enough working space below.

2) Smooth one wall of the pit with a kitchen knife or a hand shovel

3.3 Procedure

1) Provide a piece of cloth 10 cm wider and 30 cm longer than the size of the soil peel monolith to be taken.

2) Lay over the cloth on the wall of the pit and fix it well (Photo 17).

3) Provide 500 mL of the Tomack NS10 per 2000 cm² (20 x100 cm) of the soil peel in a plastic vessel with a handle.

4) Apply the Tomack NS10 resin with a brush on the cloth from the top so as to make it flow down (Photo 18).

5) Uniformly apply the remainder of the Tomack NS10 resin and spray water enough, and then leave it for about one hour until the Tomack NS10 resin hardens (Photo 19).

6) After hardening, mark the dimensions of the soil peel on the cloth which was hardened with a marker pen (Photo 20).

7) Cut about 10 cm deep soil column following the exact width of the soil peel. Don't cut the top and the bottom of the soil column and the cloth (Photo 21). Keep the excess soil peel which was cut off for repairing the soil peel monolith later.

8) Holding the soil peel which is cutting with the plywood board, remove the soil materials behind the soil column by a kitchen knife or a hand shovel from both sides of the soil column, keeping at least 3 cm thick soil peel. Cut exposed roots using pruning shears (Photo 22).

9) After cutting more than one third each of the joined part of the soil peel from both sides, push a shovel into the joined part. And pull away the soil peel from the wall of the pit, holding the soil peel with the plywood board (Photo 23).

10) Lay it down and roughly remove the excess soil materials of the soil peel with a kitchen knife.

11) Pack the soil peel underlying the plywood (Photo 24) and transport it to the laboratory for chemical treatment.

12) Proceed to 2.2-11) to finish the preparation of the soil peel monolith.

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Photo 17. The cloth is laid over on the wall.



Photo 20. After hardening, the soil peel monolith to take is marked on the cloth.



Photo 23. The soil peel is pulled away from the wall holding it with the plywood board.



Photo 18. The Tomack NS-10 resin is applied on the cloth.



Photo 21. The about 10 cm thick soil column is cut.



Photo 24. The soil peel is packed and transported to the laboratory.



Photo19. Enough water is sprayed for hardening.



Photo 22. The soil materials behind the soil column are removed.