Most stalagmites, even totems, can be repaired if the mating pieces are available. Methods vary from simple stacking procedures to more complex repair techniques using epoxy, stabilization pins, and bracing devices. Little evidence of damage is apparent after most repairs are completed.

**Stack It and Hope It Heals**

Sometimes a really simple repair strategy works for stalagmites. If water is actively dripping on broken speleothems, fit the pieces back in place and allow mineral deposition and time to take course.

**Epoxy and Stack**

At repair sites with no healing drips, or in locations where repairs may require reinforcement, clean the broken joints and use an approved archival epoxy such as Epon® Resin 828 with a Versamid® or Epi-cure® 3234 curing agent. (See cave-safe epoxies and adhesives, pages 445–447.)

Starting from the center, apply a thin layer of epoxy on the broken base or stump of the stalagmite. To avoid oozing along the seam, do not spread the epoxy all the way to the edges. Fit the upper section into place, and allow several days for thorough curing. For multiple breaks, sometimes several

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**Stalagmite Repair—Epoxy and Stack**

**Figure 1.** Spread a thin layer of archival epoxy on the clean, dry surface of the stalagmite stump.

**Figure 2.** Click-fit the upper piece onto the base and allow several days for the epoxy to thoroughly cure.

**Figure 3.** The epoxy has set and the repair is complete. The stalagmite stands again.
broken stalagmite sections can be restacked during one session (Figures 1, 2, and 3).

**Stalagmite Repair—Pin and Epoxy**

When a broken stalagmite is in a high-traffic or precarious area where it is likely to be damaged again, drill a center hole in the upper and lower mating sections and use an archival epoxy to secure a stainless steel stabilization pin. For tilted, leaning, or top-heavy stalagmite breaks, reinforce repairs with stainless all-thread rods. (See repair photo sequence of a stalagmite on a slope, pages 443–444.)

Make certain the broken pieces fit and align properly, clean and dry the break joints, and mark center guide dots for drilling. (For techniques on marking the pieces to facilitate alignment, see page 455.) In the upper section of the broken stalagmite, drill a hole the diameter of the stainless all-thread pin. Clean out the drill dust with canned air and a small brush. Apply epoxy to the pin, insert the pin in the drill hole, and allow curing to begin while drilling the lower section.

Drill a slightly oversized hole in the lower section, remove the drill dust, and half fill the hole with epoxy. Apply a thin layer of epoxy to the broken joint of the lower piece, but avoid spreading it all the way to the edges or goo will ooze from the seam and create cleanup challenges. Fit the upper and lower pieces together and brace if necessary until the epoxy cures. Add final texturing to match or mimic the original surfaces of the stalagmite.

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**Stalagmite Repair—Pin and Epoxy**

- Drill hole to achieve a tight fit for the pin. Epoxy pin into upper portion first.
- Drill an oversized hole in the base to facilitate alignment. Half-fill with epoxy.
Part 4—Repair: Werker—Stalagmite Repair

**Figure 4.** After drilling a hole in the center of the upper portion of a broken stalagmite, epoxy a stainless steel all-thread stabilization pin in place with Epon 828 and Epi-cure 3234 (TETA) curing agent.

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**Stalagmite Repair: Pin and Epoxy**

- Match the pieces and adjust for a sure fit.
- Cut part of the tip off a black indelible felt-tip marker.
- Place the marker tip in the center of the broken base.
- Align and set the top onto the base and check the fit—black ink marks will remain on both pieces to guide the drill.
- Drill the top piece to create a tight fit for the stainless all-thread.
- Clean drill dust from the hole and epoxy the all-thread into the upper section.
- Drill a slightly larger hole in the base to facilitate alignment of the two pieces.
- Clean drill dust out and half fill the bottom hole with epoxy.
- Fit the top piece that already has the all-thread epoxied in place.
- Adjust until the mating pieces align in a click-fit.
- Fill the gaps and seams with a color-matched epoxy and rock dust mixture.
- Brace if necessary and allow time for epoxy to dry.
- Sculpt the epoxy surfaces that are visible to match or mimic textures of the original speleothem.

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**Figure 5.** While allowing a little time for the epoxy in the upper piece to begin to set, drill a larger hole in the base of the stalagmite.

**Figure 6.** Half fill the larger bottom drill hole with cave-safe epoxy. Align the top piece and check the fit. Ideally, a tight click-fit achieves a tidy seam. If necessary, use an epoxy and rock dust mixture to fill cracks and gaps. (See stalagmite repair photo sequence made in Slaughter Canyon Cave, page 443.)

**Figure 7.** The top joint of this repair made a tight click-fit.

**Figure 8.** The bottom joint of the stalagmite had a large gap that was filled with an epoxy and rock dust mixture.