

Missing Paint and Escargot

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The property was a large, multi-building apartment complex in central Florida, only six years old; and the owner wanted a new paint job to freshen up the buildings. It was a typical painting/sealants job to clean, prime, seal, and paint—a minimum one-primer and one-finish coat using a high-build, water-based elastomeric paint system. A consultant was hired to develop the specifications and provide quality assurance. Bids were solicited, and a qualified painting contractor was selected. After a few months, the buildings were painted and ready for turnover and final payment. All was fine until damage began to appear!

DAMAGE BEGINS TO APPEAR

Within a few months of completion, the property management noticed areas where paint was deteriorated or missing in areas of the wall surfaces. Spots about a half dollar in size were scattered about the wall surface in random locations. The spots indicated that the tan-colored topcoat was largely gone, leaving only the white primer exposed. It was isolated and primarily in the lower five to six feet of the exterior wall. Very minor areas of the damage occurred higher up, but always below the second-floor accent band. It was a peculiar phenomenon. The most puzzling aspect of this case was that there were no paint chips on the ground below the damaged areas.

Where we saw paint spots were dete-

riorated or missing, we always noticed something extra. Small, dark, tube-shaped objects stuck to the surface of the wall—at times, as many as 10 to 15 of these objects within a square-foot area. They were stuck to the painted wall over perfectly painted surfaces. Many were curiously pigmented the same color as the paint. They were very small, so we pulled out our pocket microscopes and loops to get a closer look. Now, hold your breath.

HOLD YOUR BREATH

What were we looking at? It turns out that the objects were the excrement of some small animals, colored with paint pigment. But how could this be? Could the painting contractor actually have painted over this much debris? Not according to the consultant's records. These walls were thoroughly cleaned prior to any painting work being started. This residue problem had to have come after the painting was complete. There



Figure 1 – Conventional wisdom says that you can set out a small dish of beer to catch and rid your garden of snails. Unfortunately, you may attract local varmints as well. What does this have to do with building envelope science? Read on.



Figure 2 – The Asian Tramp Snail, a.k.a. *Bradybaena similaris*, terrorizing backyard gardens in America since 1939.

is only one practical way we know of to get paint pigment inside the stomach of an animal: It has to eat it. Then the undigested

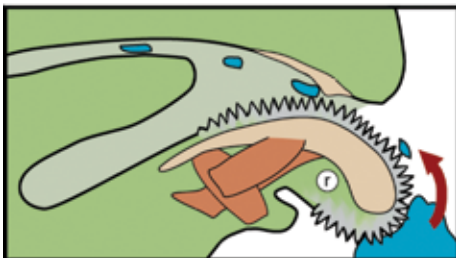
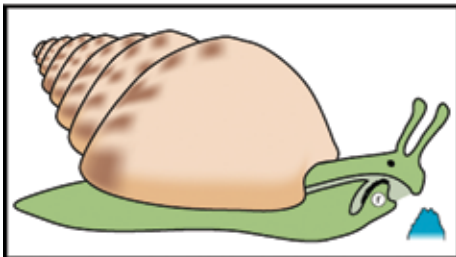


Figure 3 – A horrifying conveyor belt of thousands of tiny teeth. The paint had no chance.

remains are excreted in the animal's waste product. This might explain what had happened and exactly what we were seeing. Armed with this information, we hunted the wall surfaces, the soil below, and the bushes adjacent to find the culprit animals. Bingo, we found some small snail shells! Could these be the miscreants?

Could snails be depositing pigment-laden waste on the walls adjacent to the damaged areas? This stuff was full of undigested paint pigment. It was completely embedded within the excrement of snails that had traveled across these walls, stopping only for a meal and to relieve themselves along the way. The hunt continues.

THE HUNT CONTINUES

We continued to hunt for some actual living snails, as the shells alone could not have done the damage. Then we spotted the first snail on the lower portion of a column. He was a small snail, observed in his not-so-natural habitat, actually during his feeding time. We caught him red-handed,¹ munching away on that nice new elastomeric paint, soon joined by a few more of the culprits. These guys really seemed to like the paint. It became clear that the hungry snails were causing all of this mischief. At this point we didn't know what kind of snail they were or why they were methodically devouring the paint on these buildings.

Come to think of it, we basically knew very little about snails. So we gathered some specimens and enlisted our colleagues in academia to help identify these shelled vandals.

With the help of two talented biologists and snail experts in North Florida,² we now know our paint-eating friends as the Asian tramp snail, a.k.a. *Bradybaena similaris*. Terrorizing backyard gardens in America since 1939, this invasive species comes all the way from Asia and has since traveled into Florida. Now, these guys typically feed on soil and foliage—not paint. Something was a-foul here. It wasn't time to break out the garlic and butter just yet. What did these guys like so much about the paint? A little more research would soon answer the question.

BUILDING BLOCKS

Something about this paint was attracting the snails, so we began to research the composition to see what secrets it held. What was the delicious ingredient that this paint contained? It turned out to be calcium carbonate (CaCO_3). The paint from the bucket contained 33% CaCO_3 by wet weight measurement; and upon drying, up to 54% CaCO_3 by dry weight measurement. This simple compound, CaCO_3 , an essential ingredient in so many things on our planet (from pearls to eggshells and agricultural lime to antacid) is also the building block for these guys' shells—their homes. Snails typically eat soil and vegetation to get the calcium carbonate they need, but in this case, the paint was much more tasty!

Our friends had atypical appetites. These guys were like kids in a candy store with grandma's coin purse. They could get everything they needed to build their home—without leaving home—simply by devouring the new paint on the walls. Time to issue an eviction notice!

EVICITION NOTICE

The snails had clearly overstayed their welcome. So what was the solution? Simple enough: Iron phosphate, a nontoxic snail bait recommended by the local Extension Office to "evict" the unwanted guests. This material would be applied around the perimeters of the buildings as often as needed, essentially acting as both a barrier and a poison to the creatures. That was the first

step. Then, time to repaint.

Only the lower portions of the buildings needed repainting. (The horizontal accent band was heroically acting to deter the snails from climbing any higher up the wall.) And maybe we should try a not-so-delicious paint this time. With the known track record, we selected something that contained none of the goodies responsible for this mess—no calcium compounds to tempt any stubborn snails that might remain after our iron phosphate attack.³

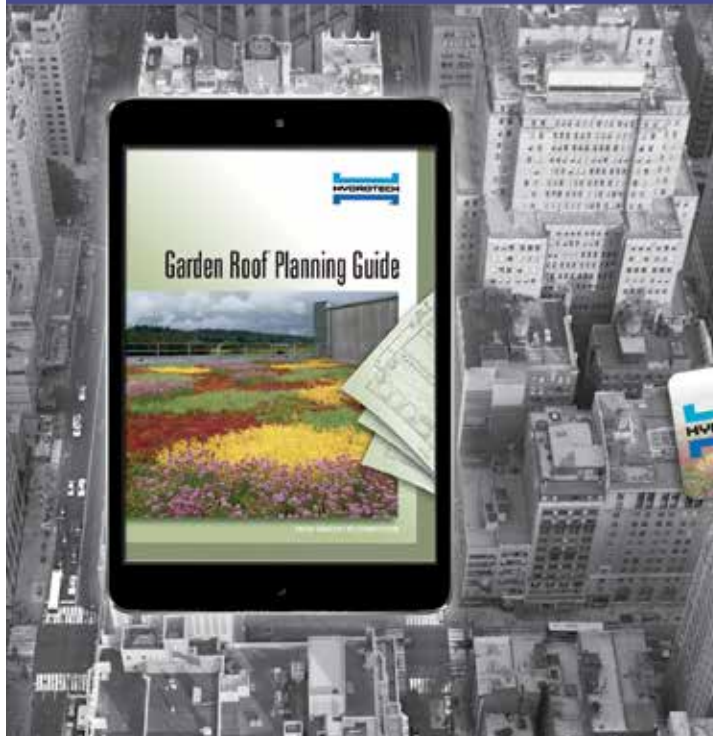
THE MORAL

In building science, we sometimes need to dig deeper and to think outside the box. One of the most important lessons we have learned in our field is to always ask questions. Why were these little black objects stuck to the wall where we were seeing the paint “failures?” How did the paint pigment get into them? Was this an



Figures 4 and 5 – The calling card our friends left us with. Inset: Snail excrement at 60x magnification. There is only one way we know of to get paint pigment inside the stomach of an animal.

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isolated incident, or could it be responsible for other paint failure cases?

Should the coatings industry now take note and look at alternate formulations for their exterior paints? Further investigation is needed, but at least for our particular client, we answered their pressing question: "What is causing the paint deterioration on our freshly painted walls?" 

REFERENCES

1. Or whatever the equivalents of hands are for a snail.
2. Thanks to Dr. Henry Lee and Bill Frank of the Jacksonville Shell Museum.
3. Since iron phosphate is very lethal to snails, we would assume any remaining strongholds to be evolutionary super snails.



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Why Women Engineers Leave the Field

Many women who earn engineering degrees are not being retained in the engineering workforce, studies show. Women comprise almost 20% of engineering school graduates, but only 11% of practicing engineers.

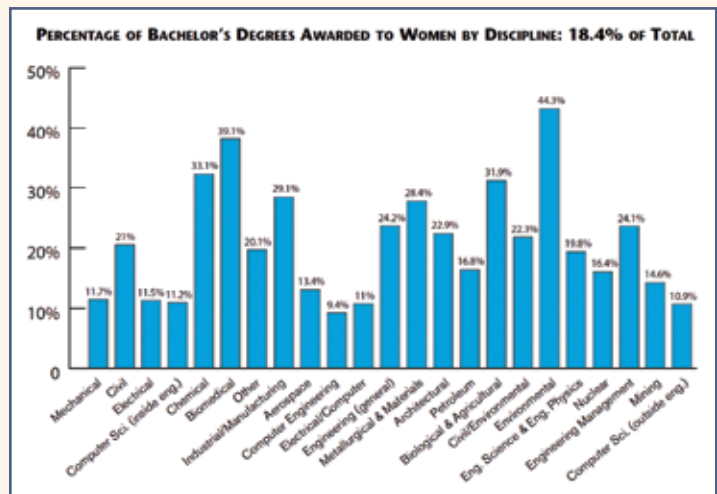
The multiyear Project on Women Engineers' Retention (POWER) study was funded by the National Science Foundation and conducted by Dr. Nadya Fouad and Dr. Romila Singh of the Center for the Study of the Workplace at the University of Wisconsin at Milwaukee.

Over 3,700 women who had earned an engineering degree responded to the survey and indicated that "workplace climate was a strong factor in their decisions to not enter engineering after college or to leave the profession of engineering," Fouad stated. Nearly 40% had quit the profession or never entered it. Yet for those who entered the industry and remained, "workplace climate" was also cited as explaining their current satisfaction.

"[Work] climate issues and lack of advancement lie at the heart of women opting out and/or not leaning in," according to analyst Nadya Fouad. Women's decisions to stay in engineering "can be influenced by key supportive people in the organization, such as supervisors and coworkers. Current women engineers who worked in companies that valued and recognized their contributions and invested substantially in their training and professional development expressed greatest levels of satisfaction with their jobs and careers."

A similar study on male engineers is currently in the works.

Though RCI has no firm data on the gender of its members (there is no such indicator on the membership application), RCI's Director of Membership Programs, Alec Jeffries, estimates RCI's female membership at around 5%, with the majority of those women members in the Industry category. Approximately 10% of RCI members (280) are self-reported professional engineers. (RCI does not independently verify this information.)



This graph, provided by the American Society for Engineering Education (ASEE), represents the percentage of women by discipline for engineering bachelor's degrees earned in U.S. universities in 2010-11. Women account for 18.4% of the engineering degrees conferred. Women represent 22.6% of those receiving master's degrees in engineering.

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