with a question from our readers: why don't more settlements use air well architectures? Many settlements, particularly relatively young ones, live in danger of severe water shortages. A number of readers wrote in asking why they see more and more commonly large stone structures for collecting water on other worlds, but not theirs, where it would seem so needed.

OL't: There is a wide variety of different atmospheric water generation, or air well, technologies. Many settlers who were recently in transit may be more familiar with fog fences, which were an easy initial way to generate minimal water upon arrival.

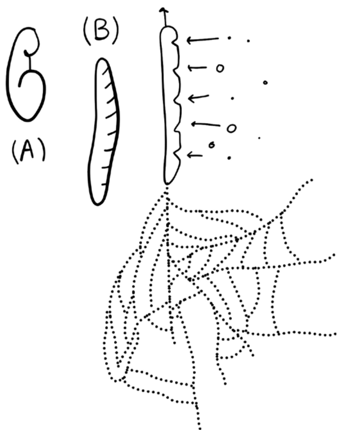

Fig: Silksynth worms unfurling (a ⟶ b) post-landing to create initial fog-fences, which will collect atmospheric dew out of microfibers constructed from a wide variety of airborne particles.

EG: After initial settling in, most new towns wanted to invest in more robust and higher-yield technologies. Air wells were initially a late-old-Earth invention, and could be split into radiative and high-mass varieties. The latter is impractical, except on worlds with access to a very different kind of stone.

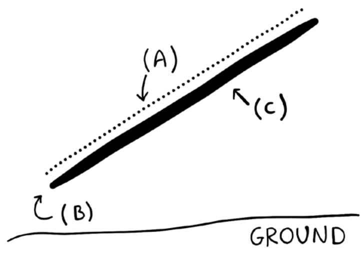

Fig: Radiative collector with (a) condensing surface, (b) gutter, (c) insulation [1]

These high-mass air wells are similar to what the readers might have seen in magazines or postcards of other locales. These are incredible structures to behold, but they work only under very peculiar conditions. They were essentially a failure on old-Earth.

Here is a reprinted explanation of why massive stone structures could not be effective:

To obtain condensation, the condenser temperature of the stones must be lower than the dew point temperature. When there is no fog, the dew point temperature is always lower than the air temperature. … wind, which ultimately imposes air temperature to the condenser, cannot cool the condenser to ensure its functioning. Another cooling phenomenon — radiative cooling — must operate. It is therefore at night-time, when the condenser cools by radiation, that liquid water can be extracted from air. It is very rare that the dew point temperature would increase significantly so as to exceed the stone temperature inside the stone heap. Occasionally, when this does happen, dew can be abundant during a short period of time. This is why subsequent attempts... to build massive dew condensers only rarely resulted in significant yields. [2]

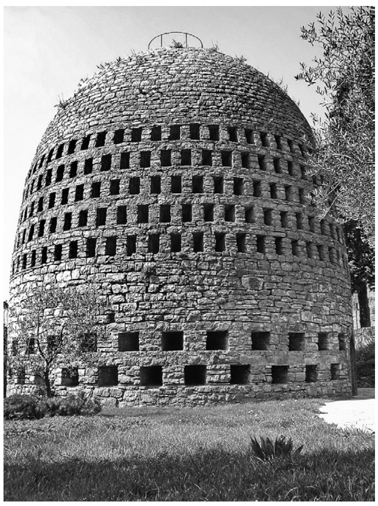

Fig: Achille Knapen's historical old-Earth structure [3]

MG: So what makes them work in some places today?

OL't: The key point that Edo brings up in the quote is that the temperature of stones in the high-mass air well depends primarily on air temperature, which is generally higher than the dew point. Some of the recent settlements have access to living-stone building blocks for their high-mass air wells. These can be very different in material and function on different worlds, but not all stones are as (relatively) passive as Terran ones are.

EG: The practical and aesthetic reality of something as a stone may not mean that it acts as a stone per se. A surprising amount of human culture follows the animal-vegetable-mineral classification, even now, as we have encountered a variety of worlds that trouble this breakdown.

MG: Returning to the subject of air wells.

OL't: Right, so, think about the canonical human concept of vegetation: more or less immobile, more or less green. Why green? Because of photosynthesis.

EG: In photosynthesis, water and glucose use the energy from the sun to create the larger glucose molecules and oxygen. It uses energy for metabolism, because it's constructing bigger molecules than what it starts with. Now, imagine you have some other metabolic reaction, some other constructive process. That will also be endothermic, meaning, using energy and cooling. There are a number of different worlds that have such "living stone" materials that can function as building blocks but undergo their own metabolic processes.

OL't: The Dweller cells are a good example of this, as they are quite active and therefore excellent for use in air well structures, but the structures require regular upkeep. Besides energy from light, these cells breakdown nutrient layers in their own outer shells for metabolism, and therefore grow smaller and more brittle over time. Simply stacking them doesn't work, and some exposure to the sun is needed to trigger metabolism, but certain architectures do help cool the structure and produce a higher yield.

EG: The important thing is to work with these stones on their own terms as organisms, embodying some combination of animal, vegetable, and mineral properties. They are more or less immobile, more or less fragile. Stunningly versatile, like old-Earth and Terran stone.

MG: Coming back to the question from our readers: "why don't more settlements use air well architectures?"

EG: In many locations, settlers do not have ready access to materials that function as building blocks in a stone heap, but which already undergo endothermic reactions internally. Or even if the materials are available, they may be hazardous or difficult to work with.

OL't: Exactly: you need special rocks, and you need to understand how to work with them.

MG: Thank you both for your time. Next time we will dive further into water systems, with a focus on water reclamation.

EG: I'll go over history and recent developments in membrane bioreactors.

OL't: And I'll highlight some practical concerns of those readers using semi-enclosed areas that rely on augmented moisture feedback for farming, where contaminant reduction is key.

MG: Please write in any questions you have, and we will make sure to cover the relevant materials.

CONTRIBUTING EXPERTS

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This interview series is made possible by questions from readers, and volunteer expert participation. Have a question, or curious to participate as an expert? Write to the editors at secondsun.reflections@gmail.com or reach out to the interview host via any IGPW channel:

Marya Grimm
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The following historical materials from the Kahaku-21B museum were used; all other illustrations and observations are sourced to the experts quoted.

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[2] Beysens, D.; Milimouk, I.; Nikolayev, V.S.; Berkowicz, S.; Muselli, M.; Heusinkveld, B.; Jacobs, A.F.G. (2006). "Comment on "The moisture from the air as water resource in arid region: Hopes, doubt and facts" by Kogan and Trahtman" (PDF). Journal of Arid Environments. 67 (2): 343–352. Bibcode:2006JArEn..67..343B. doi:10.1016/j.jaridenv.2006.01.011. Retrieved 10 September 2010.

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