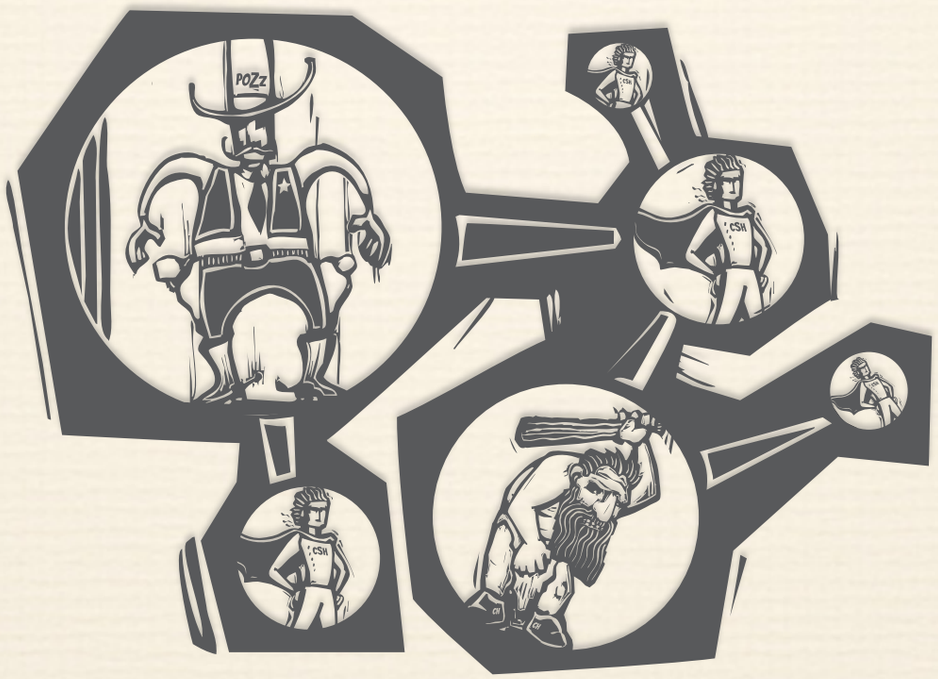
Pour Better Concrete

IGNITE A

POZZOLANIC REACTION

"think of the reaction ignited by natural pumice pozzolan
within hydrated cement paste as a molecular reclamation project..."



Why nursemaid junk concrete?

Your basic portland cement, water, sand, and gravel concrete just isn't very good. Almost as soon as it is placed, it begins to fail. In terms of longevity and durability, it tends to be a serious disappointment and an on-going maintenance headache. Replacement must happen sooner than should be necessary.

More strength from less cement. Seriously.

To make the concrete-performance equation even worse, a common method for amping concrete strength is add more cement to the mix design—and that just intensifies the deleterious side effects spawned by the hydraulic reaction between cement and water.

The secret to more strength without more cement? Pozzolan. While pumice pozzolan is not cementitious in nature, it reacts within the hydrated concrete paste to add strength to the curing concrete … a process that can continue for years.

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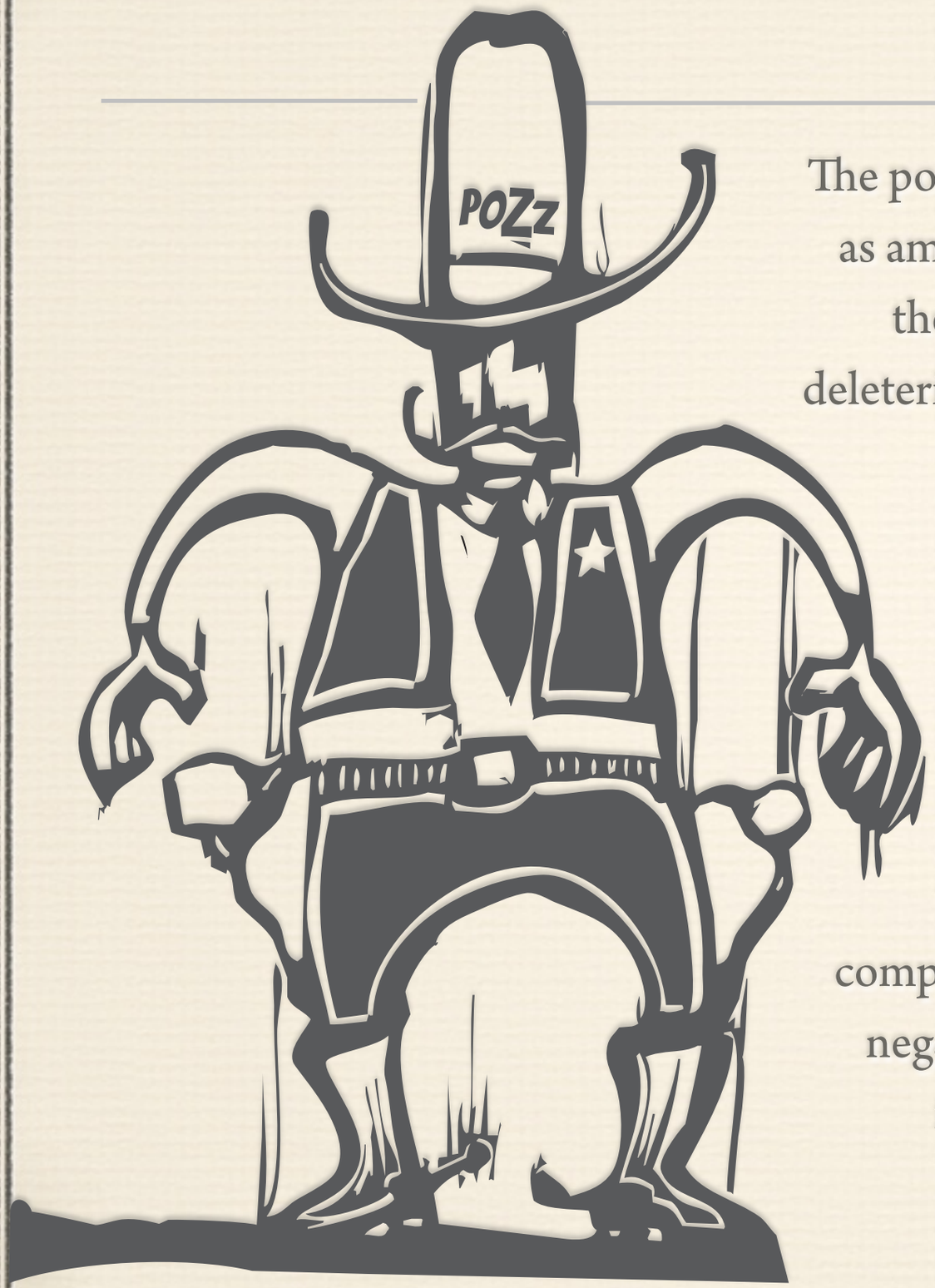
The Power of Pozzolan



The pozzolanic reaction within hydrated concrete paste is as amazingly efficient as it is transformative. Simply put, the pozzolanic reaction ignited by pumice targets the deleterious elements in the curing concrete and, via a sort of molecular reclamation process, remakes those vexing elements into additional bonding agents.

The benefit is two-fold. The troublemaking by-products of the cement-and-water hydration reaction are not only eliminated, but are repurposed. The result is a densely welded concrete matrix that not only provides additional compressive strength, the almost impermeable concrete negates the relentless attacks by chlorides, sulfates and freezing water that inevitably shorten concrete life.

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Good, Bad, Ugly

Recent studies suggest that only about 75% of the cement powder is converted to Calcium Silicate Hydrate (CSH), the binder that glues concrete together. Most of the remaining 25% is converted to Calcium Hydroxide (CH), a by-product of the hydration reaction between water and cement … a by-product responsible for much of the trouble with standard concrete.

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Calcium Silicate Hydrate

Calcium Silicate Hydrate (CSH) is what makes concrete concrete. It's the chemical magic that locks the aggregates together. The more CSH present in the hydrated cement paste, the denser the concrete matrix and the better the strength and abrasion resistance. More density means greater impermeability. Greater impermeability means increased resistance to infiltrative attacks from the outside. And effectively mitigating infiltration means a long, productive life for the concrete construct.

Calcium Hydroxide: A Bad Player

As for that by-product, Calcium Hydroxide, not only does the junk CH contribute nothing to concrete strength and durability, it instigates a handful of problems that actively work against and drastically affect the integrity of the concrete—grief like the integrity-destroying alkali silica reaction as well as a swarm of other ills. The primary crime of CH is the network of microscopic, density-compromising wormholes it leaves in the concrete as it migrates out of the concrete's interior.

A whole lot 'O grief

No only does the CH sap the compressive strength and abrasion resistance of the concrete, but that porosity opens the door for chlorides to infiltrate the covering concrete and attack reinforcing steel. Invading sulfates attack the molecular bonds of the concrete matrix. Water causes freeze-thaw damage. Efflorescence results from the migrating CH reaching the surface and reacting with the carbon dioxide in the air.

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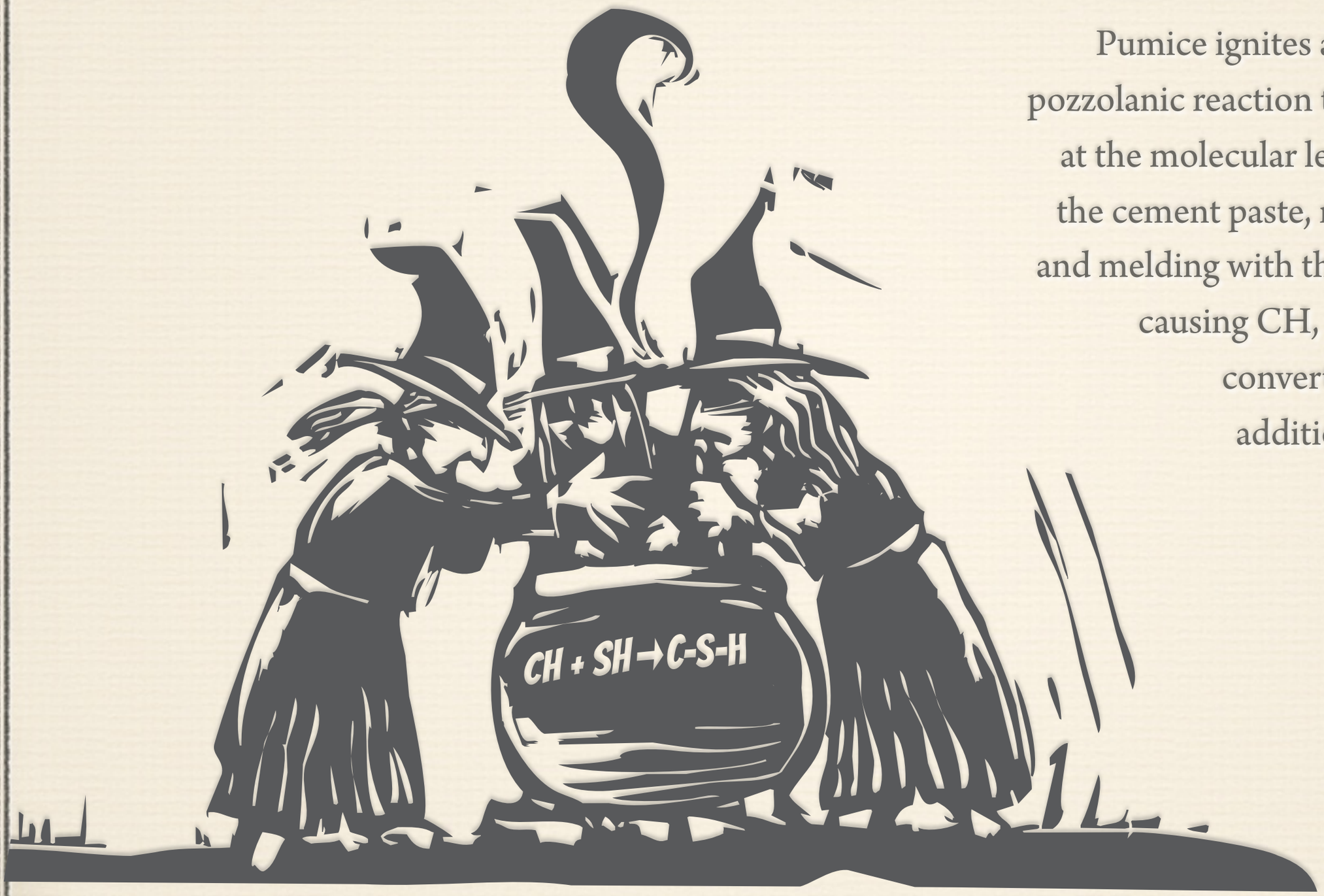
Molecular Reclamation



Pumice ignites a powerful pozzolanic reaction that works at the molecular level within the cement paste, reacting to and melding with the trouble-causing CH, ultimately converting it into additional CSH.

The Pozzolanic Reaction: Defined

The consumptive transformation of the Calcium Hydroxide mitigates or completely eliminates the problems it spawns. And that newly-created CSH does what you'd expect: it further densifies and strengthens the concrete, welding the aggregates into a dense, durable, almost impermeable matrix. This pozzolanic reaction —a molecular reclamation process, if you will—continues until the pozzolan is used up. It's a truly remarkable, effective and efficient process.

Bonus Round

ONE:

Research has shown that the reaction ignited by pumice pozzolan—HessPozz in particular—also flatlines the alkali silica reaction (ASR) … and for regions with even moderately reactive aggregate, that's huge.

TWO:

The percentage of pozzolan that is used in the mix design actually replaces the same percentage of portland cement, (up to 50%) making the cost of pumice pozzolan negligible when factoring in the cost savings realized from using less portland cement.

THREE:

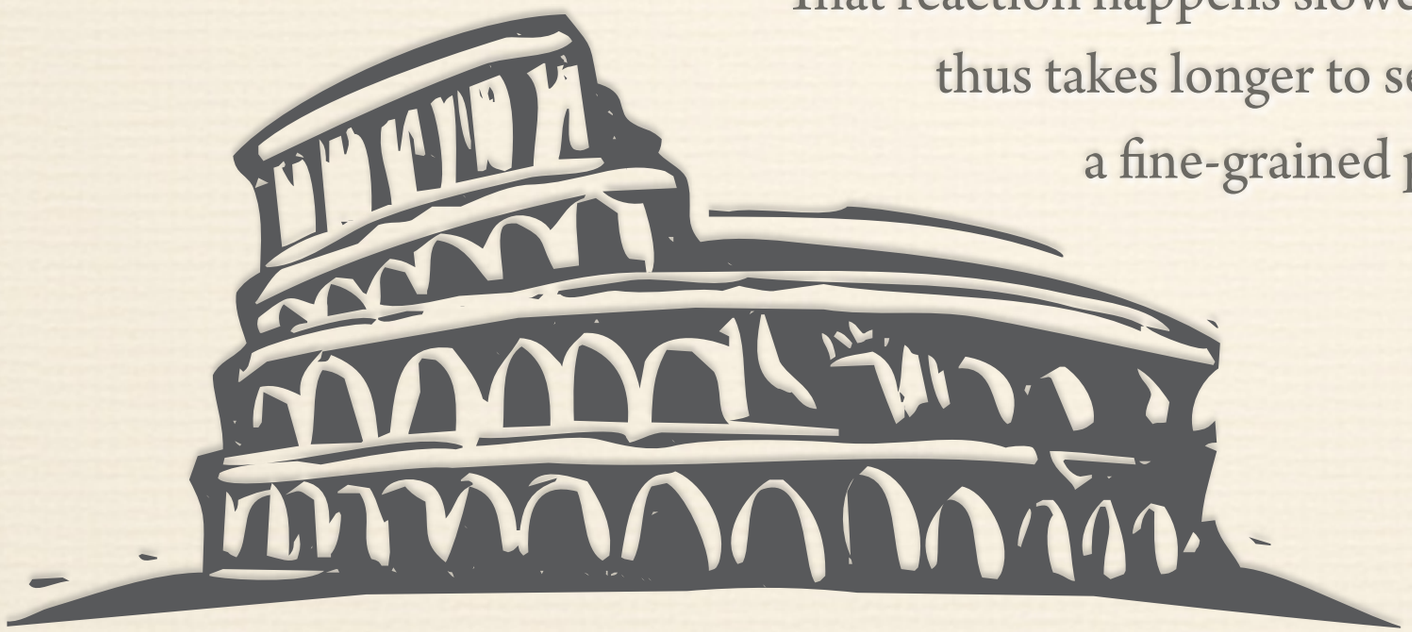
The whiteness of HessPozz (GE Brightness of 84) is a beautiful thing for those—like the precast industry—where purity of color matters.

FOUR:

Purity. HessPozz is free of crystalline silica and other hazardous materials.

The Roman connection

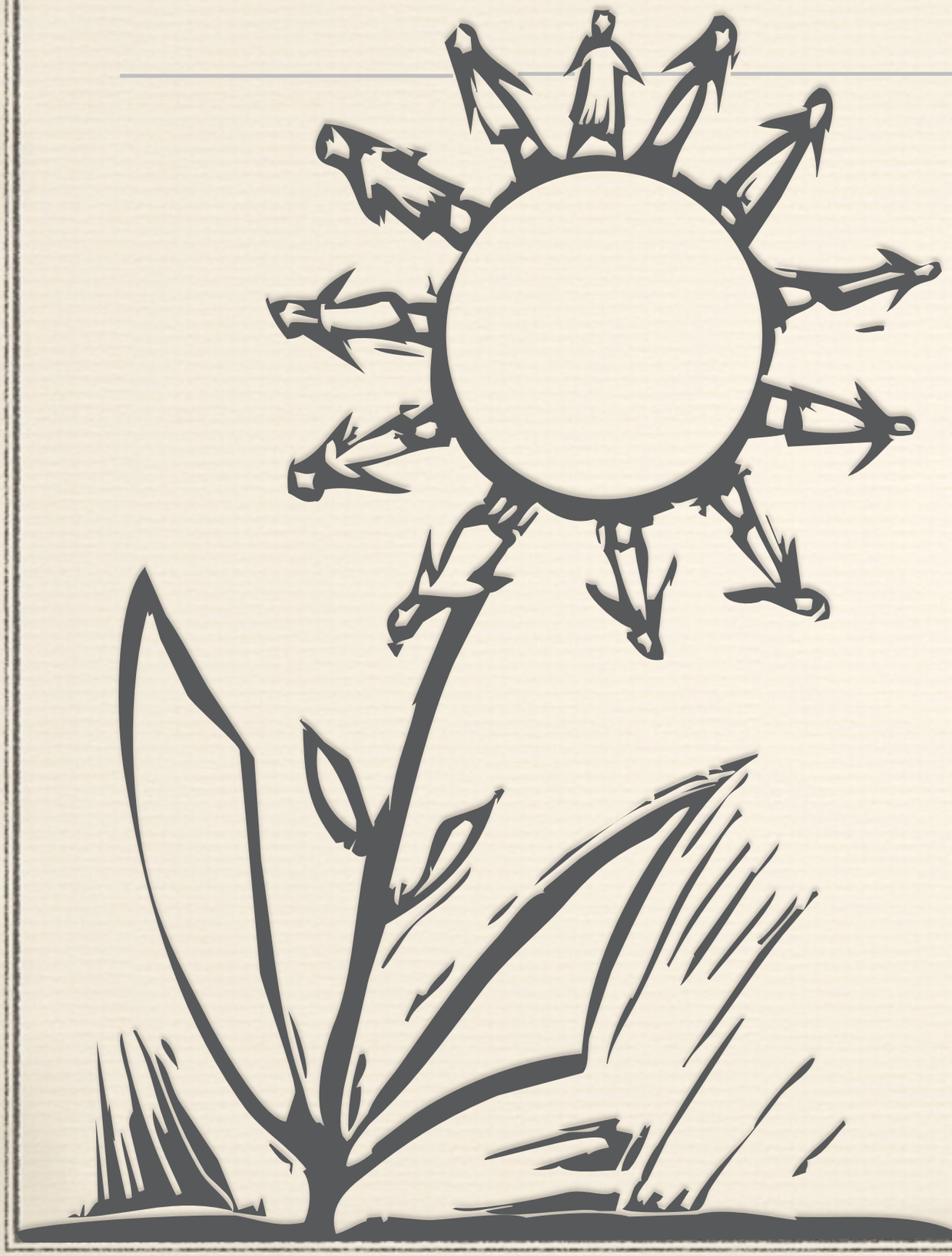
Of interest in the pozzolan story is the Romans and their amazing concrete. Some 2000 years later, their constructs of concrete—buildings, aqueducts, cisterns—still stand, having successfully withstood the ravages of time. Romans didn't have quick-setting portland cement like we use today, rather, they used a hydrated lime—made from limestone heated to drive off carbon dioxide and transform the calcium carbonate into calcium oxide (lime) + water. Lime does not act like a hydraulic cement on its own. It will only form the necessary binding CSH in the presence of water and pozzolan. That reaction happens slower than with modern cement and thus takes longer to set. The "pozzolan" they used was a fine-grained pumice they took from a deposit near a town known as *Pozzuoli*.



Nope. Not expensive.
Improve concrete for only pennies a yard

Sure, there are other pozzolans out there—contaminate-fouled and consistency-challenged fly ash being the most common—but none have the winning combination of predictable and effective performance, simple purity, low use-cost, and the green credentials of natural pumice pozzolan.

Rolling in Green



Speaking of green, the fact that pumice pozzolan is used as a *replacement* for portland cement—up to 50%—means that there is a corresponding 1:1 reduction of carbon emissions. That means for every ton of OPC removed from a concrete mix, the carbon footprint of the concrete construct is reduced by a ton.

In the end, the decision to replace a measure of portland cement with pumice pozzolan makes three kinds of sense: negligible cost, enhanced green credibility, and, most importantly, pouring a better concrete.

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