Halting the rise of salt damp

The words 'salt damp' cause many Australians the kind of anxiety aroused by the thought of cancer.

Those two little words conjure up an image of a building whose very tissues seem diseased, the masonry being eaten away from within, and the symptoms erupting in unsightly powdering and scaling as the fabric of the house falls away. Nowhere in this country is the problem worse, and public anxiety greater, than in South Australia.

One scientist who has made a study of salt damp is Mr John Hutton of the CSIRO Division of Soils. He entered this research field tangentially: for some years he was interested in the salt content of rain at different distances from the sea, and he recently showed that the chloride concentrations in Victorian rain are similar to those measured by overseas scientists in New Zealand, Eire, England, and the United States.

This work led him to an investigation of the spectacular cavernous hollows, called tafoni, in granite rocks at arid sites on South Australia's Eyre Peninsula and in the State's upper south-east. Mr Hutton, Professor Bill Bradley of the University of Colorado, U.S.A., and Dr Rowland Twidale of the University of Adelaide concluded that the tafoni, which may be up to a metre or two deep, were caused by the growth of salt crystals within the rock over thousands of years.

Salt damp amounts to rising damp with a chemical sting in its tail.

The uncorroded granite contains tiny quantities (about 0·06%) of soluble salts, mainly calcium and sodium sulphates and chlorides. The researchers believe that water percolated through the rock, gradually leaching these salts to positions near the surface, where the water evaporated and the salts crystallized within the rock's tiny pores. As the crystals grew, they splintered the granite, and over long periods the continued flaking away of superficial rock caused the tafoni that we see today.

These granites are suffering from salt damp, and have been for millennia. Many buildings, alas, are crumbling much more rapidly. They 'catch' the sickness in various ways, but they all end up with the same symptoms, caused by salts crystallizing within the pores of the masonry.

How trouble begins

Some bricks contain the germ of their own decay: like the eroded granites, they have salts in them from the start, because they were made either from saline clays, as may occur in the Adelaide area, or from brine, as happened in the early days of Port Arthur (see *Ecos* 27). If salty bricks are not adequately fired, they are very susceptible to salt damp.

Good stone and well-fired bricks normally contain no salts. Not being born salty, these materials must either achieve saltiness or have saltiness thrust upon them if they are to decay. Both fates are possible.

Saltiness is achieved by porous masonry standing on damp soil — for example, when the water table is high or a pipe has leaked. Minute tunnels in the brick or stone suck water up the wall. Then, as J. Thomson explained to the British Association for the Advancement of Science back in 1863, 'the tendency of crystals to increase in size, when in contact with a liquid tending to deposit the same crystalline substance, must push out of their way the porous walls of the cavities in which they are contained'.

In this salt-sprayed sea-front wall, mortar has outlived brick.

The result is summarized in the title of Thomson's paper: 'the disintegration of stones exposed in buildings and otherwise exposed to atmospheric influences'. This is the commonest origin of salt damp, which amounts to rising damp with a chemical sting in its tail.

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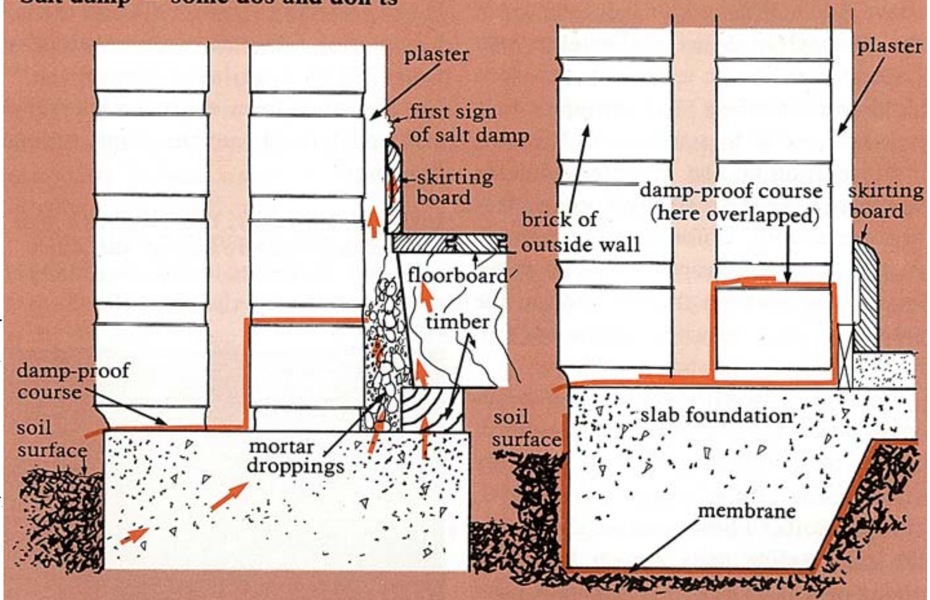
Some houses escape the dangers of under-fired salty bricks or rising salt damp, only to suffer through the ignorance or carelessness of the house-

Salt damp — some dos and don'ts



Bad design and poor workmanship: water can climb the wall via mortar droppings and via timber.

An example of good construction: the damp-proof course prevents any water rising up walls.

holder. Condensation may be allowed to linger on a bathroom wall; water may seep through a crack behind a washing machine; Adelaide's salty tap-water may be sprayed over a wall by a zealous gardener wielding a hose; or a pile of sand may be heaped against an outside wall. In such ways bricks have saltiness thrust upon them.

Parlous State

The 'atmospheric influences' referred to by J. Thomson help to explain why Adelaide and some other parts of South Australia head the national salt damp league. The faster the water evaporates from within an affected brick, the sooner the crystals will do their damage. South Australia's mediterranean climate — cool, wet winters and hot, dry summers — ensures that evaporation exceeds precipitation for 10 months of the year. Even after a winter shower the humidity soon drops and evaporation recommences.

In Adelaide the net movement of water through walls is not down, but up.

In a tropical or humid city the rains leach salts out of the masonry, but in Adelaide the net movement of water through walls is not down, but up.

North of Adelaide the problem is even more severe. High temperatures, wind, and low humidity push Port Augusta's evaporation up to 2250 mm a year, 50% above Adelaide's, and Dr Bill Spencer of the Australian Mineral Development Laboratories likes to tell how he has seen children riding their bikes through a hole in a wall caused by salt damp in Whyalla.

In addition to the climate, Adelaide has that saline tap-water and ocean spray to contend with. Unfortunately for South Australia, a high proportion of its population lives close to the sea and, on the sea-front itself, exposed brickwork suffers badly from salt spray.

But the salty soils cause most headaches. Salinity has now been measured at about 180 sites in Adelaide, largely through the efforts of the CSIRO Division of Soils. These studies show that the most saline soils are on low-lying plains near the coast, but scientists have yet to determine the critical salt concentrations at which soils can cause problems for buildings.

Salt damp takes its toll of unprotected bricks.

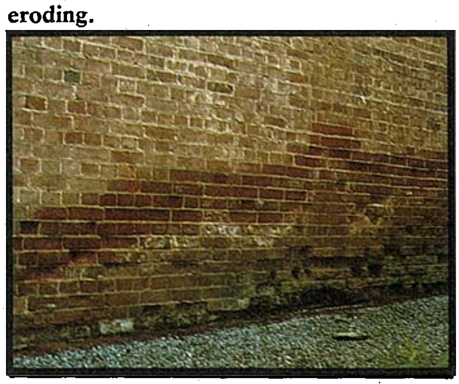
This will prove a tricky job, as a soil may have different salinities at different depths, and the vertical distribution of salt may be altered by a house that sucks water out of the soil. Scientists have already discovered that a building may draw salt from several metres below the soil surface.

Research Committee

One sobering way to measure salt damp is in dollars. Concerned at the extent of the problem, the South Australian government set up a Salt Damp Research Committee in 1974. In its first report, published 2 years later, the Committee estimated that the cost of eliminating salt damp from the 300 000 or more homes affected was $15 million at 1976 prices.

The Committee, of which Mr Paul Peter of the CSIRO Division of Soils is a foundation member, did not try to put a figure on the economic damage salt damp has caused to public buildings, but the report did point out that the State's historical buildings, such as Government House, Adelaide Town Hall, and the Old Legislative Council, were severely affected. (The Legislative Council building has since been expensively restored and transformed into the Constitutional Museum.)

Like blotting paper, this clay-brick wall has sucked moisture out of Adelaide's salty soil. Below the damp zone, salts show, and the base of the wall is eroding.



The Salt Damp Research Committee offers advice to an understandably worried public, in the form of free leaflets and inexpensive booklets like 'How to Avoid Salt Damp'. It also commissions research, in particular from Amdel (The Australian Mineral Development Laboratories) and the University of Adelaide.

The bricks or stones below the damp-proof course bear the brunt of any saline assault from the soil.

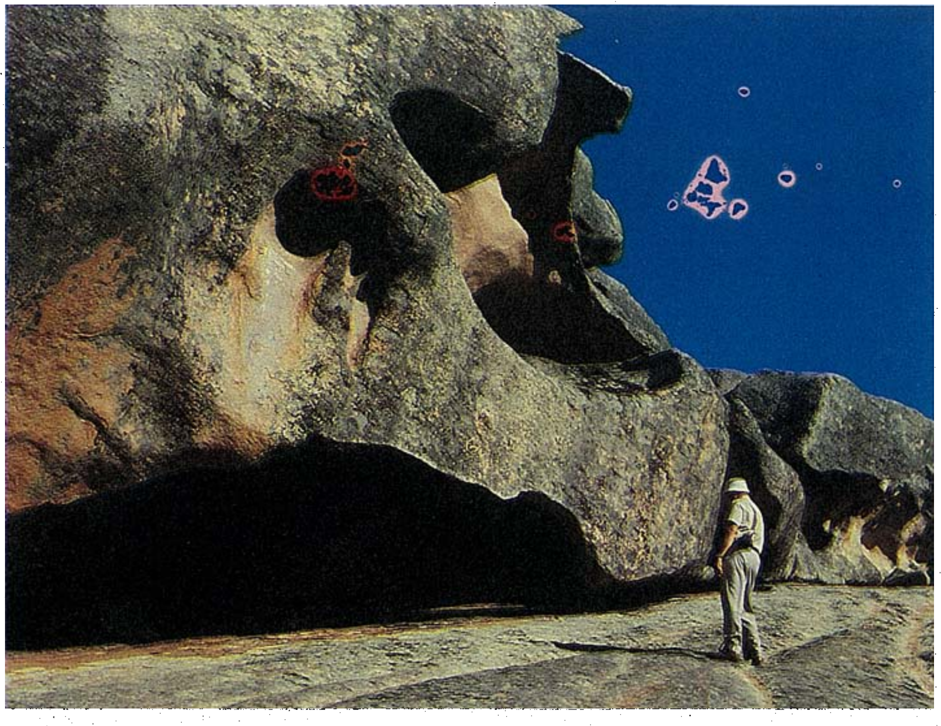
This research is essential because each part of Australia has a unique combination of soils and climate, and advice and materials that are suitable in other States may well prove inappropriate in South Australia.

Damp-proof course

Most of the fabric of a wall should be protected by a layer of impervious material that insulates the upper wall from any rising water. The importance of such a damp-proof layer was apparently first acknowledged by South Australia's legislators in 1881, when they enacted a schedule requiring brick, stone, and concrete walls to be 'provided with a damp-proof course or courses other than wood, which shall be above the surface of the ground or cellar floor'.

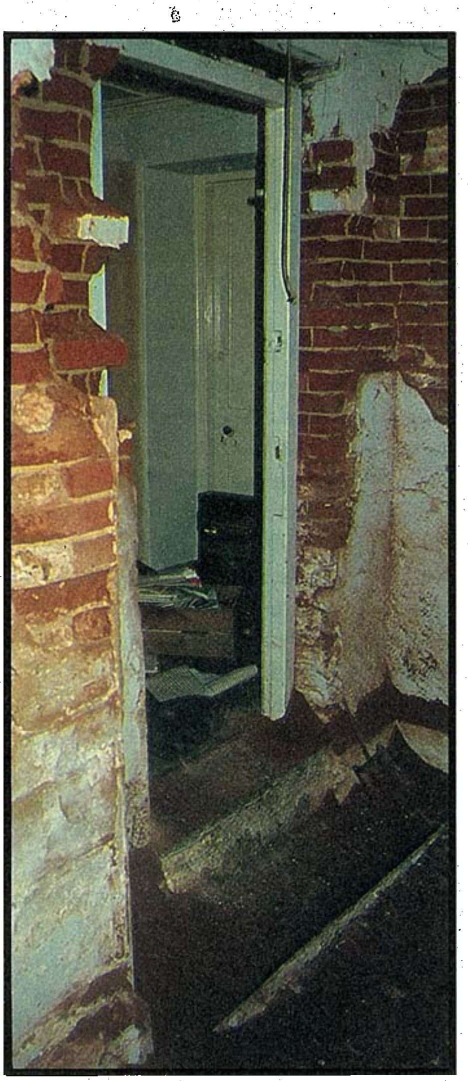
'Other than wood' has the merit of brevity, but a century later scientists are prescribing more stringent specifications. Some bitumens are squeezed out of the wall under load, and others become brittle with time. Metals tend to corrode. Even bitumen-coated metals have failed to satisfy Amdel researchers.

At present the most reliable material for a damp-proof course seems to be



Given time, even granite succumbs to salt damp, as here, on South Australia's Eyre Peninsula.

Miniature walls under investigation by the Salt Damp Research Commmittee.



The draught through a doorway accelerates evaporation and therefore erosion.

polyethylene, although Mr Barry Dillon of Amdel considers the usual thickness of 0·25 mm inadequate: 'a half-brick dropped from 2 cm will penetrate it, as will a hammer from 20 cm'. Sand grains easily puncture it when trodden in, too. Drawing attention to the British Standard (0·46 mm) and to the thickness commonly sold in the United Kingdom (0·55 mm), Mr Dillon argues 'thicker polyethylene would be better'.

The bricks or stones below the damp-proof course bear the brunt of any saline assault from the soil. For this part of the wall, the Salt Damp Research Committee advises against the cream-coloured bricks that are so fashionable in Adelaide, because these have been relatively lightly fired; it recommends hard, well-burned bricks in moisture-resistant mortar — or a salt-resistant stone, such as granite, marble, or most slates.

In some parts of Australia, buildings can be protected against salt damp by 'pressure injection', which involves impregnating porous materials with an impermeable substance such as a latex or siliconate. Scientists have found this unsuitable for Adelaide, where moisture inhibits the substance's movement and salt tends to occupy the pores in bricks and prevent the protective chemical from taking up its intended position.

Dr Maurice Arnold of the University of Adelaide is investigating the movement of water (both liquid and vapour) through bricks before and after treatment with waterproofing chemicals, and hopes to find ways to increase the effectiveness of chemical injection.

There is still much scope for research into salt damp. Dr Alan Spry of Amdel suggests that scientists should investigate further the influence of climate, the chemical changes to masonry caused by salt, and the possible role played by micro-organisms in the decay of stone.

However, the greater challenge facing South Australians now seems to be applying the knowledge already gained. Many of the State's affected homes are less than 10 years old. The Salt Damp Research Committee warns: 'Buildings are being erected right now which are sure to become salt damp casualties at some time in the future, because the principles set out in "How to Avoid Salt Damp" are being ignored'.

John Seymour

More about the topic

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'Salt Damp-proof Courses — Materials.' (Salt Damp Research Committee: Adelaide 1980.)