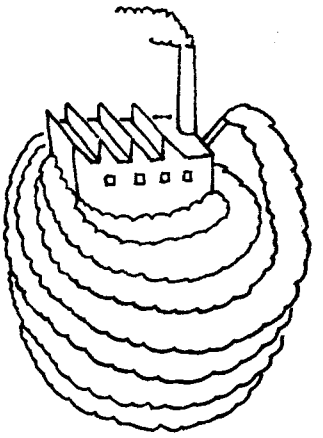
Getting out of the quicksand problem

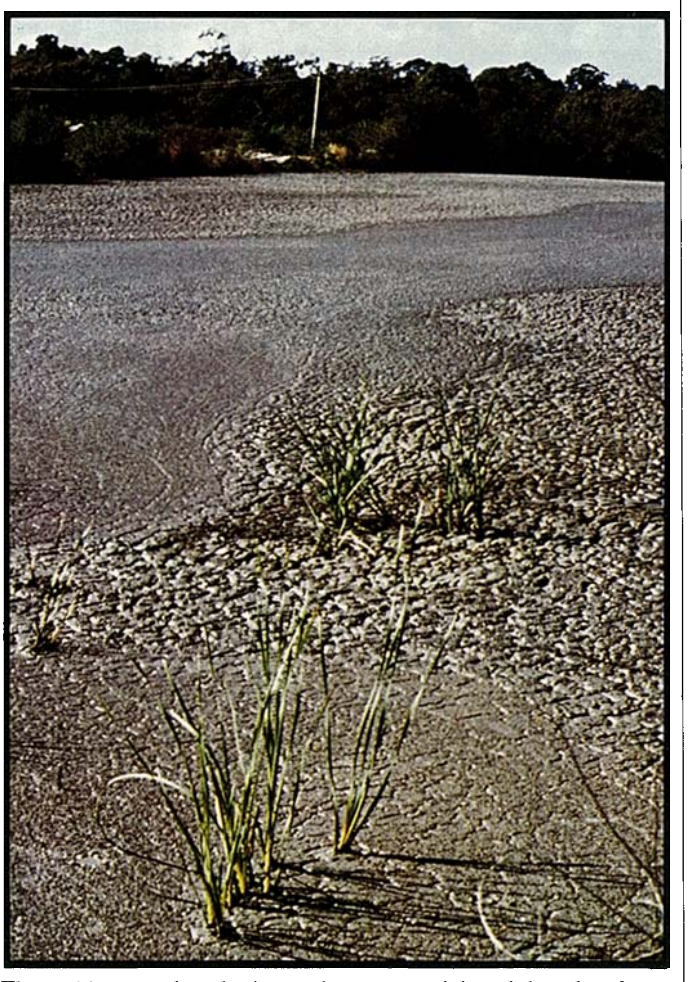
Many of our sand-washing plants are in a spot of trouble. They are slowly being surrounded by a growing body of quicksand of their own making. Since the plants are usually in the fringe of our metropolitan areas, their problem is also one of more general concern.

The quicksand comes from clay that is washed from sand wanted for use in the building industry. The sand is mined by directing a strong jet of water onto the pit wall; the resulting slurry is pumped away and the sand separated by a cyclone. The suspension of fine clay that remains is pumped to ponds or worked-out pits, where is settles to a soupy sludge, quietly remaining like that for years.



The problem is that the sludge occupies a much bigger volume than the original sand. The result is that the settling areas are filling up, and new sites are at a premium these days since every sizeable hole is pounced on by local councils eager to find a place to dump domestic refuse.

To get rid of the quicksand, it is necessary to dry the material to a stage where it can be handled as a solid. This could be done with mechanical filters or centrifuges, but only



The problem: sand washeries produce more quicksand than they do washed sand.

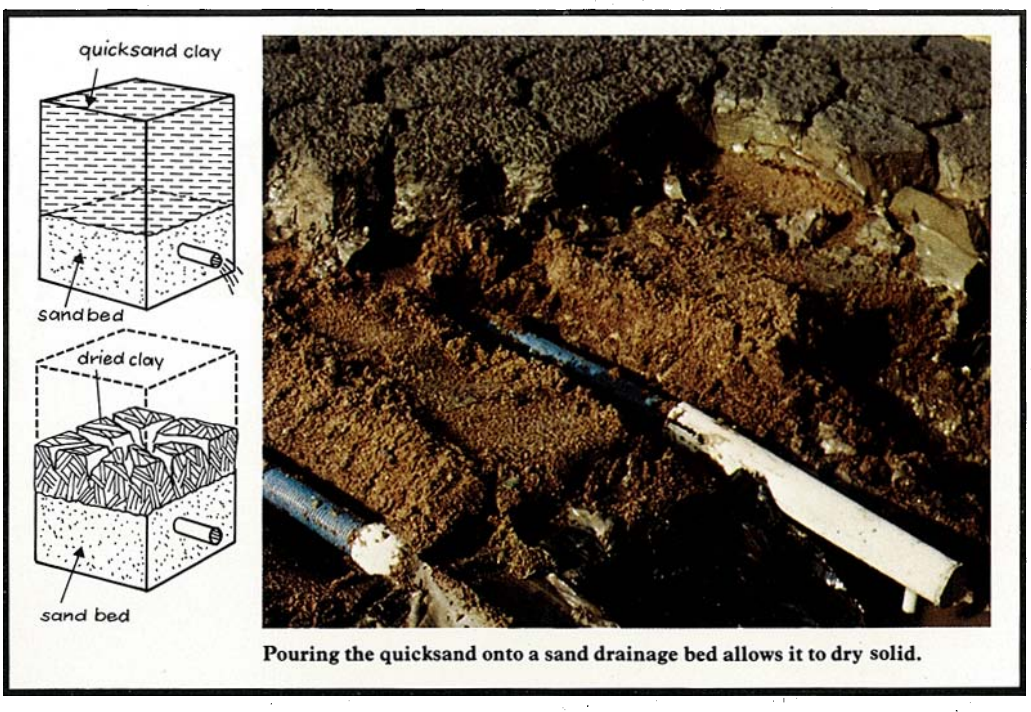
at a cost which is at present out of proportion to the value of the material being produced.

The CSIRO Division of Mineral Chemistry has been seeking a simple and less expensive method for drying the clay sludge. Dr Graham Sparrow of the Division has made a study of the problem and found that gravity and sunshine, if wisely used, can do the job.

The key to the new approach is to use shallow draining ponds that retain only the solids, instead of the usual deep ponds which retain the water as well. The importance of drainage was pointed out by Dr David Smiles of the Division of Environmental Mechanics on the basis of his studies of water movement in clays.

Dr Sparrow and his co-worker Mr Werner Ihle have carried out laboratory and field tests using sand beds to provide the drainage. Some of the water drains out from the bottom and evaporation takes place at the surface. While drying is going on, the clay will not redisperse if wetted, and so rain-water simply runs off.

At around 60% water content, the clay sludge cracks open at the surface. These cracks penetrate further into the material as the drying proceeds, speeding up the process. Within a month, a clay slurry 0·5 m deep can be dried solid (20–30% water content).

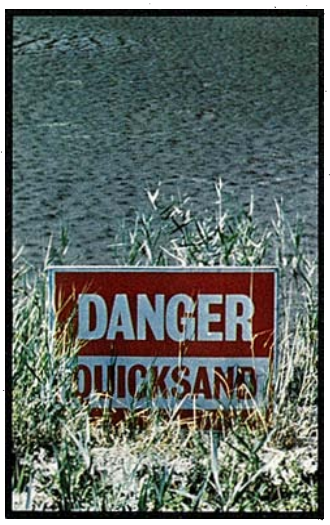


Pouring the quicksand onto a sand drainage bed allows it to dry solid.

The depth of sludge which can be dried is limited by the need for the cracks to eventually penetrate down to the sand bed, and this depth depends on the season of the year. In average Melbourne weather, the depth can be more than double that which could be achieved without drainage.

When the mud cake is dry, it can be cleared away and more clay suspension can be run onto the sand. There are good prospects for using the dried material in brick-making, and it can certainly be used as land fill. A Melbourne sand washery has begun to use the drainage method on a trial basis.

The researchers point out that slow settling of the clay particles is not really the limiting factor. Although clay may sometimes exist as a colloid (a suspension of very fine particles that often never settles), Dr Sparrow found that most of the clay in the washery effluent had coagulated or flocculated into larger aggregates. The real problem is that these aggregates don't form a dense, closely packed sediment; they form a gel in which clay platelets are randomly orientated, resulting in a very open structure containing a huge amount of water.



Dr Sparrow and Mr Ihle are looking for chemical and mechanical methods for producing gels in which the clay platelets are more closely packed. In the meantime, they consider that their drainage scheme can be successfully used to dry the clay suspensions generated by sand washeries. The muds, slimes, and sludges produced in other industries could also be similarly treated. Red muds arising from the production of aluminium and the sludges from coal washeries could be likely candidates for treatment.


Mining the sand with a jet of water.

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