THE LIFTING EFFECT OF QUICKSAND

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Two extremes of opinion regarding the lifting effect of quicksand may be briefly stated. One of these, in fact, the opposite of lifting effect, is exemplified by the general picture of quicksand deposits as lying in wait to entrap and engulf the unwary. This is the quicksand, not only of novels such as *Lorna Doone*, *Moonstone* and *Assignment in Brittany*, but also it is a very common belief. Certainly, each year, quicksand is the cause of loss of considerable numbers of domestic animals, of human lives and of considerable property. The other opinion was stated in 1931 in an article in *Science News Letter* (3) as follows: "You're Safe in Quicksand If

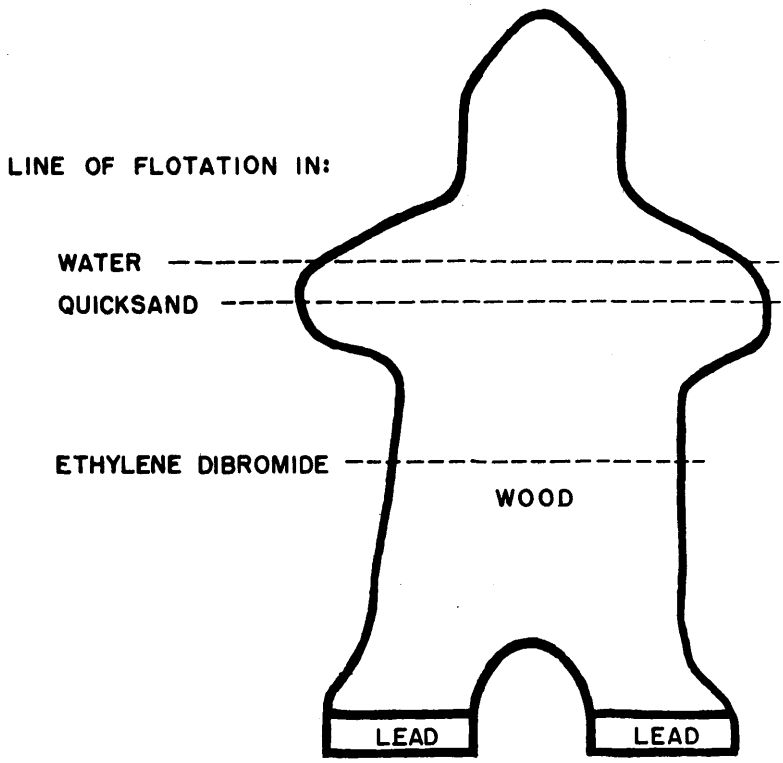

FIG. 1. Comparison of Buoyancy of Water and Ethylene Dibromide with Lifting Effect of Quicksand.

You Keep Still. . . . If you ever have the misfortune to fall into quicksand, don't get panicky and thrash around. If you keep quiet, allow yourself to go down feet first and keep your arms outstretched, you will soon find yourself resting at a depth just below your armpits. As a matter of fact, quicksand will support you twice as easily as water."

In view of the theory of what makes quicksand "quick," as proposed in 1900 by Hazen (2), later by Burt (1) and at somewhat greater length by the present writer

in 1945 (4), it was decided to test exactly the lifting power of a given quicksand. This theory, in brief, is that quicksand has its particular properties because water (a spring) is rising through it with sufficient velocity to lift the sand grains apart; thus the immersed body is going down into water, handicapped by the sand and under the lifting effect of the buoyancy of the water as well as the rising current. To study exactly this lifting effect, a model of wood (*Liriodendron*) (Fig. 1) was made, with strips of lead fastened on the feet to keep the model upright in liquids.

The levels to which it sank in water and in sand made quick by rising currents were marked on the model. (Fig. 1.) The lifting power of the particular quicksand used was then determined by use of an hydrometer to be equal to that of a liquid with a specific gravity of 1.156. This is between one-sixth and one-seventh greater than that of water. The exact level will be determined by two factors: (a) the specific gravity of the entrapped body (a man with hunting boots and a cartridge belt or a man who when swimming has difficulty floating and can easily sit down on the bottom of a swimming pool may be entirely engulfed); and (b) the velocity of the rising current. It is this second factor which leads the writer to use the term, "lifting effect," rather than buoyancy, buoyancy being only part of the "picture." The necessary velocity of the rising current will be determined by the weight of the individual grains of sand, the coarser and heavier the grain, the greater the velocity and the greater the lifting effect of the quicksand.

The lifting effect corresponding to that of a liquid with a specific gravity of 1.156 does not agree with the statement in the *Science News Letter*, ". . . quicksand will support you twice as easily as water." To check just how high a liquid with twice the buoyancy of water would lift the model, it was put in ethylene dibromide, specific gravity of 1.96. Figure 1 shows that this liquid, with a specific gravity of nearly two, lifts the model very much higher than quicksand. Thus quicksand has a lifting effect, not twice that of water, but about one and one-seventh times that of water.

REFERENCES

(1) **Burt, F. A.** 1927. Genesis of Quicksand Deposits. *Pan. Am. Geol.*, 47: 226.
(2) **Hazen, A.** 1900. Discussion of Quicksand. *Trans. Amer. Soc. Civ. Engrs.*, 43: 582.
(3) *Science News Letter*. 1941. You're Safe in Quicksand if You Keep Still. 39: 232.
(4) **Smith, Ernest Rice.** 1946. Sand. *Proc. Indiana Acad. Sci.*, 55 (In press).