if one uses for V_{at} (in Eqs. 4 and 5) the liquid atomic volume at the melting point and not more.

The viscosity at the melting point, η_{mp}, can be estimated for any metal from Andrade's well known expression:

$$\eta_{mp} = 5.7\ ([\text{at.wt.}] \times T_{mp})^{1/2}/(10^4 \times V_{at}{}^{2/3}) \tag{8}$$

More data supporting the above relationship, as well as a detailed discussion of the theory, will be presented elsewhere. Suffice it to show here two typical examples, namely, Na and Zn. The diffusion measurements are due to Nachtrieb and his associates (*4*) while those on viscosity are taken from the *Liquid Metals Handbook* (*5*).

Figure 1 shows four series of experimental results—that is, the viscosity and diffusion of Na and Zn, respectively, are compared with two sets of straight lines of the same numerical slope, but of opposite sign, for viscosity and diffusion. The four specific equations of these straight lines, in the form of the general equations 2 and 3, are as follows [η in poises, D in cm^2/sec, T in deg K, $R = 1.9865$ cal(deg K)$^{-1}$ (g-atom)$^{-1}$].

For Na

$$\eta = 0.84 \times 10^{-6} T\, e^{-0.28} e^{+2500/RT}$$
$$D = 7.95 \times 10^{-4} T\, e^{+0.44} e^{-2500/RT}$$

and for Zn

$$\eta = 2.00 \times 10^{-6} T\, e^{-0.20} e^{+4800/RT}$$
$$D = 4.64 \times 10^{-4}\, e^{+0.42} e^{-4800/RT}$$

The constants B and D_0 of Eqs. 2 and 4 and Eqs. 3 and 5 were calculated by using Debye temperatures, θ_D, of 192°K and 213°K and liquid atomic volumes at the melting point, V_{at}, of 24.76 and 9.45 cm^3/g-atom for Na and Zn, respectively.

Figure 1 shows that the experimental points fit the theoretical lines very well and that the same E_{VD}, that is, 2500 cal/g-atom for Na and 4800 cal/g-atom for Zn, describes both viscosity (η/T) and self-diffusion equally well, within the accuracy of the measurements.

The adjustment of experimental points to the theoretical lines involving B, D_0, θ_D, and E_{VD}, is possible essentially only by adjustment of Frenkel's e^{γ} or $e^{-\gamma}$ factor; it is close to unity and for a perfect agreement γ should be identical in Eqs. 2 and 3.

Finally, from the general equation for E_{VD} (that is, Eq. 6) we obtain for Zn and Na, with their $T_{mp} = 693$°K and 371°K, respectively, heats of activation of 4700 and 2400 cal/g-atom.

In summary, one can estimate from the above relationships the viscosity or self-diffusion of any liquid metal, over a substantial temperature range, from its known melting point.

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Direct Readout of Sediment Analyses by Settling Tube for Computer Processing

Abstract. *Sediment fall-velocities measured by the Woods Hole Rapid Sediment Analyzer can now be obtained directly on punched paper tape in a form suitable for processing by a computer. This technique saves much time because it eliminates manual card punching, a step in which an operator transfers values from sediment analyses to punch cards in order to make the data acceptable to computers.*

One of the most useful measurements utilized by sedimentologists and engineers is the separation of a sediment sample into classes of grains according to their size. For many years the standard way of doing this has been to shake a weighed sample through screens of known sizes and to weigh the fractions collected on each screen. Another way to make the measurement has been to permit the sample to settle in a column of water and by one means or another to measure the spectrum of fall-velocities. Since fall-velocity is a function of grain-size, one can interpret the fall-velocities in terms of grain size. Although there are some difficulties associated with the interpretation of grain-size distribution from fall-velocity, such methods are widely used and for many problems are quite satisfactory.

A few years ago much of the tedium was removed from sedimentary analyses by fall-velocity techniques when an analyzer was built which recorded the frequency distribution of fall-velocities present in a sediment sample directly in the form of a linear graph (*1*). Use of this instrument, the Woods Hole Rapid Sediment Analyzer, has been increasing. It has the advantage of being fast and providing highly reproducible results.

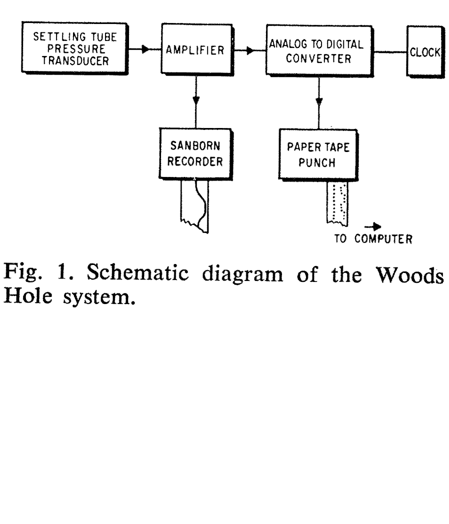

Fig. 1. Schematic diagram of the Woods Hole system.

We report here that the next logical step has been taken and that the output of this analyzer can now be obtained directly in a form acceptable to a high-speed computer. It is now possible to run as many samples as one wishes and get the resulting cumulative frequency distribution in the form of punched paper tape (Fig. 1). Since March 1964, a 1-meter settling tube with a Sanborn-270 pressure transducer and differential transformer has been used with the analyzer at Woods Hole. A Sanborn Carrier Pre-amplifier (Model 150-1100) with power supply (Model 150-400) excites the differential transformer and amplifies its signal which is fed into a Dynamic Systems Electronics analog-to-digital converter (Model ADC-1-B2PT) driving an eight-channel paper-tape punch at ten readings per second.

The punched tape is processed on a GE 225 information processing system which can be programmed to yield all the benefits of high speed computing.

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