ently intended to leave the orbit from near the perigee position by means of a retro-rocket system. The observed discontinuity in the orbital period of the satellite seems to suggest that the satellite was misaligned at the time of firing and, as a consequence, the retro-rocket placed both the capsule and the transmitting section into a higher orbit than that of the rocket.

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OCEANOGRAPHY

Ocean Currents in McMurdo Sound

Measurements of ocean currents in McMurdo Sound, Antarctica, were made during May and June 1959, by measuring the potential differences developed between three silver–silver chloride electrodes hung in the sea below the ice.

Initially the electrodes were placed in the sea at the same location to determine the contact potentials and to estimate their variations. The electrodes, labelled N, W and S, were then placed out, N 500 m. north and W 500 m. west of the third electrode S which was 5 km. from Scott Base (77° 51′ S. and 166° 48′ E.) and on a line bearing 200° from it. The electrodes were connected by cable to Scott Base where the potentials between adjacent pairs were recorded by a four-point Honeywell Brown recorder.

On magnetically disturbed days the records were too disturbed to be of use. The records from calm days were selected and the values recorded by each adjacent electrode pair were averaged over a whole day, thus eliminating the tidal effect, which was mainly diurnal, leaving the general ocean drift. Since the instantaneous sum of the N–S and S–W potential differences equalled the N–W difference, the averages found for the respective channels should agree likewise.

For the purposes of calculating the currents it was assumed that there was a uniform flow in a straight channel. After consideration of the formula derived by Longuet-Higgins[1] for flow in a semi-elliptical channel, it was assumed that the shape of the channel and the conductivity of the bedrock were in this instance not important factors. A value of 0·69 oersted was used for the vertical component of the Earth's magnetic field. The results of the analysis of 18 days records are listed in Table 1, giving a mean velocity of 7·5 cm. sec.$^{-1}$ in a direction 44° east of north. Short-term current meter readings were in general agreement with this mean. These results indicate a different direction of drift past Cape Armitage (from McMurdo Sound towards the Ross ice shelf) from that which has been observed during summer months[2].

Lead strip electrodes, placed on the surface of the ice, which was 2 m. thick, were tried also; but the experiment had to be abandoned before conclusive results could be obtained, although the few records obtained indicate that despite a larger contact potential it would be possible to get useful results.

A more detailed account of these measurements, together with associated hydrological and tidal observations, is in preparation.

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[1] Longuet-Higgins, M. S., *Mon. Not. Roy. Astro. Soc.*, Geophys. Supp., **5**, 285 (1949).
[2] U.S. Hydrographic Office, Washington, Report on Operation Deep Freeze, 1, *TR*-33, 16 (1956).

Table 1. Speed and Direction of Ocean Currents in McMurdo Sound

	May 1959																
Date	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4
Velocity (cm. sec.$^{-1}$)	11·3	11·4	6·4	5·7	7·0	2·2	6·6	11·1	12·0	2·2	5·4	8·3	10·1	11·3	12·3	10·8	9·0	6·9
Direction, true	22°	16°	10°	34°	79°	36°	357°	80°	76°	54°	33°	24°	39°	44°	71°	69°	59°	0°

GEOLOGY

Average Composition of Granites, the Genesis of Tektites, and Petrogenesis

The recent article by Lovering[1], in which the average chemical composition of tektites was compared and contrasted with the average composition of terrestrial shales, calcalkaline granites and granophyres, involves an important question which is too frequently ignored. Comparison was made with the average bulk chemical composition of shales (78 analyses from Clark's Tables), granites (72 analyses quoted by Nockolds) and acid granophyric differentiates of basic magma (35 analyses available in the literature). As a basis of discussion, it may be assumed that the bulk chemical analyses are accurate representations of each of the 185 samples involved. Probably it is reasonable to assume that each of the 185 specimens was chosen by a competent geologist as a 'typical sample' to represent the rock-mass concerned.

The vast majority of granitic bodies which outcrop at the Earth's surface have received some qualitative but virtually no quantitative study. Thus, there are virtually no granite plutons for which anything like adequate information is available as a basis for determining the quantitative composition of the two-dimensional outcrop (representing the random section through the rock-mass). Even less is known about the three-dimensional composition and variability. At the present time, meagre quantitative data