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PATRICK TOLLIN
PETER MAIN
MICHAEL G. ROSSMANN

Department of Biological Sciences,
Purdue University,
Lafayette, Indiana.

GEORGE W. STROKE
ROBERT C. RESTRICK

University of Michigan,
Ann Arbor, Michigan.

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ENGINEERING

Hysteresis in the Flow through an Orifice

IN a recent investigation into the behaviour of square-edge circular orifices a well-defined hysteresis in the flow was measured. This was obtained with air for a number of orifices of different diameters but of the same length/diameter ratio, equal to one-half. The experimental measurements were made under carefully controlled conditions and could be reproduced at different times.

It is curious that this phenomenon had not been encountered earlier in the long history of investigation of the flow of compressible fluids.

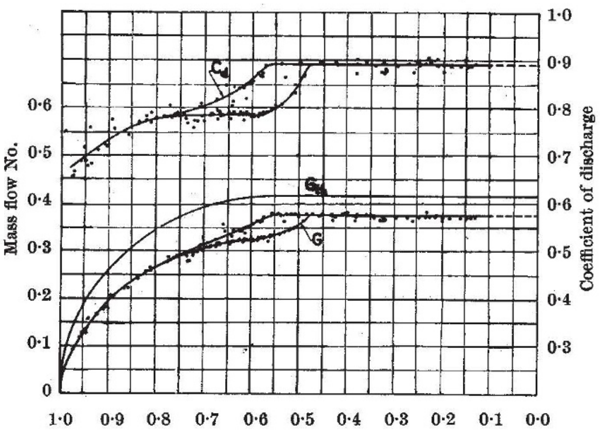

Fig. 1. G, Mass flow number; C_d, coefficient of discharge; G_{th}, theoretical mass flow number based on isentropic flow

The precise nature of the hysteresis is at present under detailed investigation, but it is thought that it is essentially a manifestation of the Coanda effect. It is seen from Fig. 1 that the orifices are choked when, presumably, attachment of the jet is fully secured. The measured mass flows are also the highest among a number of different orifices (thirty-eight in all) with length/diameter ratios ranging from 0·05 to 2·0.

B. E. L. DECKKER

Department of Mechanical Engineering,
University of Saskatchewan,
Saskatoon.

GEOLOGY

Greenstones from the Central Valley of the Mid-Atlantic Ridge

IN a preliminary report[1] of a recent study of the morphology of the Mid-Atlantic Ridge about 22° N. latitude, attention was directed to the dredging of a suite of greenstones from the western face of the central valley. Although similar rocks have been recently reported from the Carlsberg Ridge[2] in the Indian Ocean, rocks of this type have not been previously recorded from the Mid-Atlantic Ridge. Preliminary petrographic examination and chemical analysis of the Mid-Atlantic Ridge greenstones justify the present interim report.

The collection from the upper slope (Dredge 2, 2,670–2,050 m) consists, as noted[1], of fragments of greenstone, basalt, and partly metamorphosed basaltic tuff. The fragments exhibit a thin manganiferous coating, usually on all sides. This observation and the angularity of the fragments suggest that they were collected from a slowly accumulating talus slope. The collection from the base of the slope (Dredge 3, 4,000–3,200 m) consists of greenstones, and rare fragments of diabase. The greenstone fragments exhibit only very thin and spotty manganiferous coatings, rarely on more than two faces. The distribution of these coatings, and the fresh uneroded aspect of the uncoated faces, indicate that these rocks had been only recently exposed. The preservation, unbroken, of thin platey fragments in Dredge 2 we take to indicate that the fresh surfaces of the Dredge 3 fragments are unlikely to have been produced by fracturing within the dredge.

The greenstones consist of actinolite, epidote, chlorite and plagioclase in various proportions. The latter is mainly albite although some specimens contain relics of more calcic plagioclase. Dredge 2 contains greenstones which are essentially free of epidote whereas in those in Dredge 3 epidote is abundant. Although searched for specifically, zeolites and pumpellyite have not been noted in the 13 greenstones which have so far been examined in detail.

Most of the greenstones are not deformed. In some of the specimens shear planes occur but they are widely spaced and give no well-defined fabric. Because of this lack of intense penetrative deformation, the pre-metamorphism textures are preserved. These show that some of the greenstone fragments were derived from submarine basaltic flows and others from basaltic tuffs.

One of the greenstones analysed has unusually high sodium content (Table 1, No. 1). This specimen is textur-

Table 1. CHEMICAL ANALYSES* OF TWO GREENSTONES AND A REPRESENTATIVE BASALT

	(1) Greenstone Dredge 3	(2) Greenstone Dredge 2	(3) Fresh basalt Dredge 2
SiO_2	50·84	49·71	49·10
Al_2O_3	15·25	15·32	15·27
Fe_2O_3	2·89	2·05	2·54
FeO	4·55	7·31	8·36
FeS_2†	0·19	not sought	not sought
MnO	0·16	0·16	0·20
MgO	9·32	8·92	8·09
CaO	6·44	7·32	10·61
Na_2O	4·48	2·93	2·86
K_2O	0·05	0·05	0·25
H_2O^+	3·26	3·53	0·56
H_2O^-	0·74	0·93	0·25
TiO_2	1·38	1·51	1·73
P_2O_5	0·10	0·17	0·16
	99·65	99·91	99·98

(1) Epidote—actinolite—chlorite—albite.
(2) Quartz—chlorite—actinolite—albite.
(3) Rare plagioclase (An_{82}) and olivine (Fo_{85}) phenocrysts.

* Content as percentage of air-dry ground sample. Analysis by standard wet methods for silicate rocks. Analyst Eugene Jarosewich.

† Calculated assuming all sulphur in pyrite, the only sulphide visible in polished sections.