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REPORT OF THE NORTHERN NATIONAL MEETING OF THE CAVE RESEARCH GROUP OF GREAT BRITAIN. 3 - 4 JULY, 1965.

by

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The Northern National Meeting of the Cave Research Group of Great Britain took place during the first weekend in July, at Settle and on Casterton Fell. The formal part of the meeting was held in the Ashfield Hotel, Duke Street, beginning at 5.30 p.m.

The ex-officio Chairman, Mr. W.H. Little, opened the meeting in the absence of the Chairman, Mr. D. Cons.

The first paper of the evening was given by Mr. D.T. Richardson, A.R.I.C. on the subject of water testing. A comprehensive display of water testing equipment and reagents was also on view.

The paper opened with a brief review of the classical equations for the solution of limestone by ground waters and the available Cave Research Group and University of Bristol Speleological Society literature on the topic. Mr. Richardson then made his main point, which was that the development of modern reagents, polythene equipment, and methods of analysis, etc. has now made it possible for the enthusiastic amateur to carry out analyses and make accurate observations without formal chemical training or the necessity of an expensively-equipped laboratory. A comprehensive list of equipment, reagents and methods of analysis was given, with details of suppliers and costs.

Accuracy is, however, no less essential, and the temptation to publish suspect results, where the sample has been obtained with difficulty, must be resisted. The method of analysis should always be given in publications, in particular the method used for determining p.H. values. The use of papers and colorimeters (e.g. the Lovibond Comparator) for p.H determination is not convenient under cave conditions although the latter [66] method can be used to a relatively high degree of accuracy on the surface. The electrical p.H meter gives excellent results under all conditions. The three methods have progressive orders of accuracy, but are also progressively more expensive.

Results of work in the Alum Pot area, Marble steps Pot, Goyden Pot, Lost John’s system and at Kilnsey Crag were reviewed. The importance of the contribution of feeder streams to the hardness of the main stream was stressed. Comparison results for an area must be taken on the same day.

Mr. Richardson concluded his paper with an appeal for professional chemists to train enthusiastic amateurs in methods of analysis; and for cavers to collect samples of water from specified points in caves for analysis in the laboratory, provided that samples are accurately identified and located, and delivered without delay.

Discussion of the paper raised a number of interesting points. Samples should be taken with as little disturbance as possible - undue disturbance can introduce errors in p.H values and free carbon dioxide determinations, turbid samples should be filtered before analysis. Results of analysis may be used to trace waters and prove connections. The most suitable volume for a sample is half a pint. Results may be correlated with flow rates and meteorological observations with interesting effect.

A type of p.H paper, manufactured in Germany, incorporates three indicators, and gives more accurate results than the single-indicator type of paper, which in theory are designed for use with buffered solutions. Water boards may be able to supply flow measurements for a specific period. The second paper of the evening was given by Mr. K. Ashton on the subject of Cave Hydrology, a topic which admirably complemented that of the first paper.

Mr. Ashton propounded a simplified hypothesis of the hydrology of a cave, which is an application of the classical ‘black box’ concept. The input point is the sink, and the output point the resurgence. The problem is essentially dynamic, and the input pulse is the flood wave which enters a cave when it rains. The interior of the ‘black box’ is generally represented by a model based on the supposed contents of the ‘box’ - in this case a model of the cave is substituted. Predictions may then be made for the form of the output pulse, and these my be related to field observations.

The assumptions made are that the water enters the cave from non-Karstic rocks, that there is one flood wave only, and that the cave model consists of sink, vadose passage, master cave, flooded zone and resurgence. It is then possible to represent the input pulse, master cave observations and output as graphs of flow (F), total hardness (H), and pH against time. The three series of graphs are given on Plate E. The input pulse begins at time t., when the flow increases. At this time the total hardness and [67] pH can be expected to decrease, since the volume of water is increased. The master ca.ve observations will exhibit a change at some later time t_1, when the flood wave arrives in the master cave. The total hardness will have increased. Since the master cave and the resurgence are connected by an incompressible column of water in the submerged zone, the flood wave will arrive at the resurgence at time t_1. Shortly after time t_1 the total hardness, which has a markedly higher ambient value, may show an increase attributable to pockets of harder water drawn into the flow from the submerged section. The arrival of the flood water will be indicated by a marked increase in hardness. pH will in general show a similar trend. The area under the flow graph between

the times of arrival of the flood water at the beginning of the submerged zone and the resurgence will give an approximation to the actual volume of the submerged zone.

There are of course snags to this simple hypothesis. Multiple inlet passages will give rise to multiple input pulses, while oxbows and ‘optional sinks’ will also give multiple pulses.

The method of analysis of data is to search for correlation between the input and output graphs. It is possible to express the graphical data as arithmetic (binary) numbers for analysis by digital computer.

Certain practical conditions must be satisfied if sufficiently accurate observations for the evaluation of the ‘black box’ model are to be made in the field. pH values must be accurate to 0.05 or better. All observations must be taken at intervals of not more than 15 minutes - ideally the records should be continuous. A quiescent state should be present before the passage of an input pulse is observed.

The discussion concentrated on technical points. The merits of the analogue computer” in the analysis of simple models were recommended. Syphon action may give rise to an ‘active element’ providing multiple pulses. Electrical conductivity nay perhaps be substituted for pH in the observations. Turbidity effects may give valuable information.

Mr. A.L. Butcher proposed the vote of thanks to the speakers and the hosts, the Red Rose Cave and Pothole Club. The formal part of the meeting was followed by dinner at the Ashfield Hotel. On the Sunday caving meets were held on Casterton Fell, the main attraction being a through trip from Cow Pot to Pool Sink. Another very successful national meeting was thus concluded.

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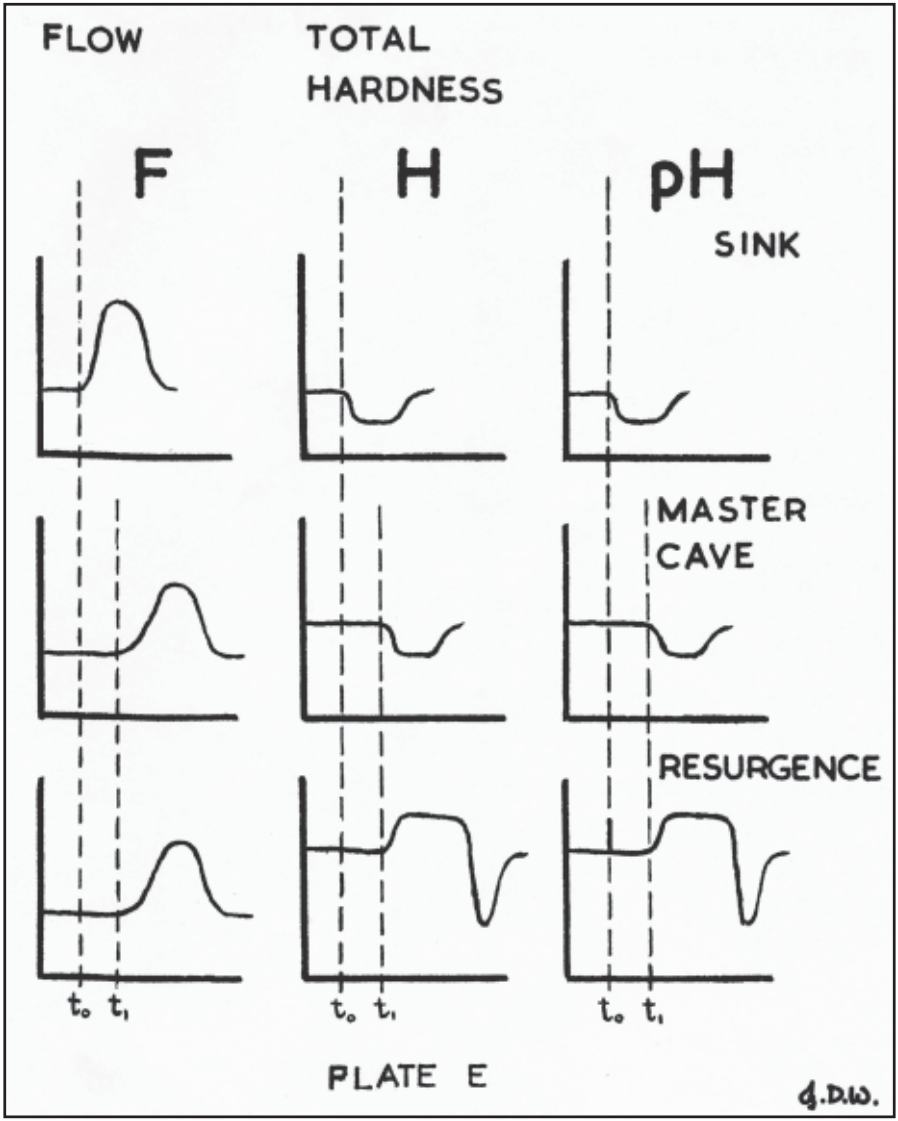
FLOW
TOTAL HARDNESS
F
H
pH
SINK
MASTER CAVE
RESURGENCE
t_o t_1
t_o t_1
t_o t_1

PLATE E

J.D.W.