Table 2. APPROXIMATE SPECTROGRAPHIC ANALYSIS OF FLUORITE SAMPLES FROM REDBURN MINE, CO. DURHAM

Sample No.:	67/1925	67/1926	67/1927
Colour:	Green	Purple	Colourless
Fluorescence:	Intense, bluish	Strong, purple	Weak, purple
Analysis (p.p.m.)			
Lanthanum	200	< 5	5
Cerium	< 5	5	5
Praseodymium	20	< 20	< 20
Neodymium	200	< 20	< 20
Samarium	20	< 20	< 20
Europium	80	5	8
Gadolinium	10	< 1	2
Terbium	< 20	< 20	< 20
Dysprosium	50	10	10
Holmium	10	< 10	< 10
Erbium	20	10	10
Thulium	< 10	< 10	< 10
Ytterbium	7	5	5
Lutetium	< 10	< 10	< 10
Yttrium	~ 500	~ 500	~ 500

At present the only mine in the area producing green fluorite in any quantity is Redburn Mine, working the Red Vein, north of Rookhope Village, which also produces purple and colourless varieties. An approximate spectrographic determination of individual rare earths in these three varieties (Table 2) has shown that, in this mine too, it is the green variety that is rich in europium. This variety also exhibits an intense bluish fluorescence similar to that observed from the green variety from Stotfield Burn Mine, which also works the Red Vein, but south of Rookhope Village.

The extent of variation of the europium content of green fluorite is not known, but analyses obtained so far have indicated that a general level of 100 p.p.m. can be expected in the material from the Red Vein. Any process designed exclusively to produce europium from this material is likely to prove economically unattractive. A process, designed to recover a rare-earth concentrate as a by-product from plants utilizing this fluorite for the production of fluorine chemicals, would give a material rich in europium and poor in cerium that would be a convenient starting material for the extraction of europium.

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Graptolites of the *Monograptus hercynicus* Type recorded from Malaya

I RECORDED Lower Silurian graptolites from Malaya 8 years ago[1]. Since their discovery during the geological mapping of the Langkawi Islands large areas of north-west and central Malaya have been systematically mapped on a 1 in. : 1 mile scale by the Geological Survey of West Malaysia. As a result of this work more than 100 further graptolite localities have been found in Kedah, Perak and Pahang States, and among the graptolites found have been those of *Monograptus hercynicus* type, which has previously been described only from Central Europe, the Yukon Territory and Australia. I am now examining collections of these fossils.

The majority of the graptolites are within the range Llandoverian to Wenlockian, but it is very interesting that material from at least seven localities contains recognizable monograptids of the *M. hercynicus* type. Although these latter fossils are usually poorly preserved there is enough detail to permit comparison with the following described species: *Monograptus hemiodon* Jaeger, *Monograptus praehercynicus* Jaeger, *Monograptus uniformis* Pribyl and *Monograptus yukonesis* Jackson and Lenz. Two new species of the group are also present.

The descriptive palaeontology, stratigraphical significance and distribution of *M. hercynicus* type monograptids, which are among the youngest graptolites to occur, have only recently been made known by the work of Jaeger[2,3]. Although Perner[4] in 1899 described two species from beds in Bohemia which he considered might be of Devonian age, it remained for Jaeger to show conclusively that these graptolites were confined to beds of post-Ludlow age. The researches of Jaeger in Central Europe and of Jackson and Lenz[5] in the Yukon Territory of Canada, together with other instances from North America and Central Asia quoted by Berry[6], indicate that shelly faunas which are either intimately or closely associated with these graptolites are of early Devonian aspect and more precisely they allow correlation of the host strata with the Gedinnian and part of the Siegenian Stages.

In Malaya the suggested Lower Devonian chronology is corroborated by the frequent association of *M. hercynicus* type monograptids with dacryoconarid tentaculites. Several forms of these pelagic organisms can be distinguished. Bouček (personal communication) has identified the ribbed species *Tentaculites matlockianus* Chapman and the smooth shell *Styliolina fisurella* (Hall). *T. matlockianus* is said to be very close, if not identical, to *Nowakia acuaria* Richter of middle Lower Devonian age and the styliolinid is indicative of a Lower to Middle Devonian age.

The intention of this preliminary communication is to put on record a further global occurrence of monograptids of the *M. hercynicus* group. It is also gratifying to note that these and the abundance of the earlier Silurian graptolites have assisted greatly in determining the lower and middle Palaeozoic age of strata covering more than 2,000 square miles of Malaya which were previously classed as Late Palaeozoic and Early Mesozoic.

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PHYSICS

Atmospheric Electric Field as a Possible Cause of Radio Pulses from Extensive Air Showers

VARIOUS mechanisms have been proposed for the origin of the radio pulses which are found[1–6] to be associated with large cosmic-ray extensive air showers. While these proposed mechanisms differ in detail, they all depend essentially either on enhanced Cherenkov radiation from an electron excess in the shower[7] or on charge separation effects in the Earth's magnetic field[8]; these effects are believed to contribute about equally to the observed pulses[2]. It appears that charge separation by the electric field of the lower atmosphere may also play a significant part under certain atmospheric conditions.

The existence of a vertical electric potential gradient in the atmosphere has long been known; the surface of the Earth carries a negative charge and the upper layers of the air a positive one. At altitudes of up to a few kilometres the average fine-weather field is ~ 100 V m^{-1} and above this height the gradient falls steadily to a value ~ 1 V m^{-1} at an altitude of ~ 20 km. The precise values vary with locality, time, season and weather. Under disturbed weather conditions the vertical gradient may be much higher. Gradients of ~ 500 V m^{-1} occur