FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

TECHNICAL MEMORANDUM NO. 39 OF 1967.

INTERIM REPORT ON THE CHARACTERISTICS OF THE VOLATILE MATTER OF COALS.

by

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RESEARCH FOR THE COAL MINING
RESEARCH CONTROLLING COUNCIL

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A preliminary study was made of the application of pyrolysis - gas chromatography to coal dusts. A correlation between the explosibility index of a coal and the nature of its volatile matter would prove useful.

Pyrolysis - gas chromatography is carried out as follows. A quantity of coal dust is formed into a small cylindrical pellet (ca. 1mm x 1mm) in a metal die under pressure. Pellets made from bituminous coals have sufficient mechanical strength without the addition of a binder. The coal dust pellet is pyrolysed in a small electrically heated platinum spiral in the sample injection part of a gas chromatograph. The volatile pyrolysis products are swept directly into the partition column of the chromatograph by the inert carrier gas. A non-selective partition column which separates the components of a mixture strictly according to boiling point is used.

The thermal degradation products of coal are extremely complex and the chromatograms show various prominent peaks due to single major components superimposed on a background of a large number of unresolved minor components. Pyrolysis products with boiling points up to 350°C are eluted from the column.

Chromatograms of the volatile matter produced when D.N.C. and Pittsburgh coal dust was pyrolysed at approximately 300°C, 450°C and 600°C are reproduced in Figures 1 and 2. The exact pyrolysis temperature is difficult to determine. The large peak at the start of each chromatogram represents methane with further minor gaseous products which are unresolved. No attempt was made to identify any of the other peaks.

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The following differences can be noted in the chromatograms of the volatile pyrolysis products of the two coals studied:

(a) The methane peak is much larger in the case of Pittsburgh than D.N.C. at a corresponding temperature.

(b) The peak indicated by an arrow is larger for Pittsburgh than for D.N.C. Heavier fractions are formed even at 300°C.

Further tests were carried out to determine whether it is possible to differentiate between coal which had taken part in an explosion and fresh coal. Partially charred coal dust collected from the walls and base of the Hartmann tube after ignition was compared with fresh coal. There is a slight difference apparent in the chromatograms in Figure 3. The coal removed from the Hartmann tube consists of a mixture of charred as well as unaltered coal which will tend to mask any prominent differences between the two chromatograms. The method holds promise since only an extremely small amount of coal (ca. 0.1mg.) is required to carry out a test.

The platinum spiral used in these preliminary experiments is not a suitable energy source since it does not reproduce the rapid heating rate which prevails during a coal dust explosion. The rate of heating of the coal is probably at least a hundredfold too slow. A more suitable energy source would be a spark discharge, flash tube or laser.

A literature survey of the various aspects of the flash pyrolysis of coal is in progress.

PRETORIA.
6th September, 1967.
/JE

A.A. MEINTJES.
Research Officer.

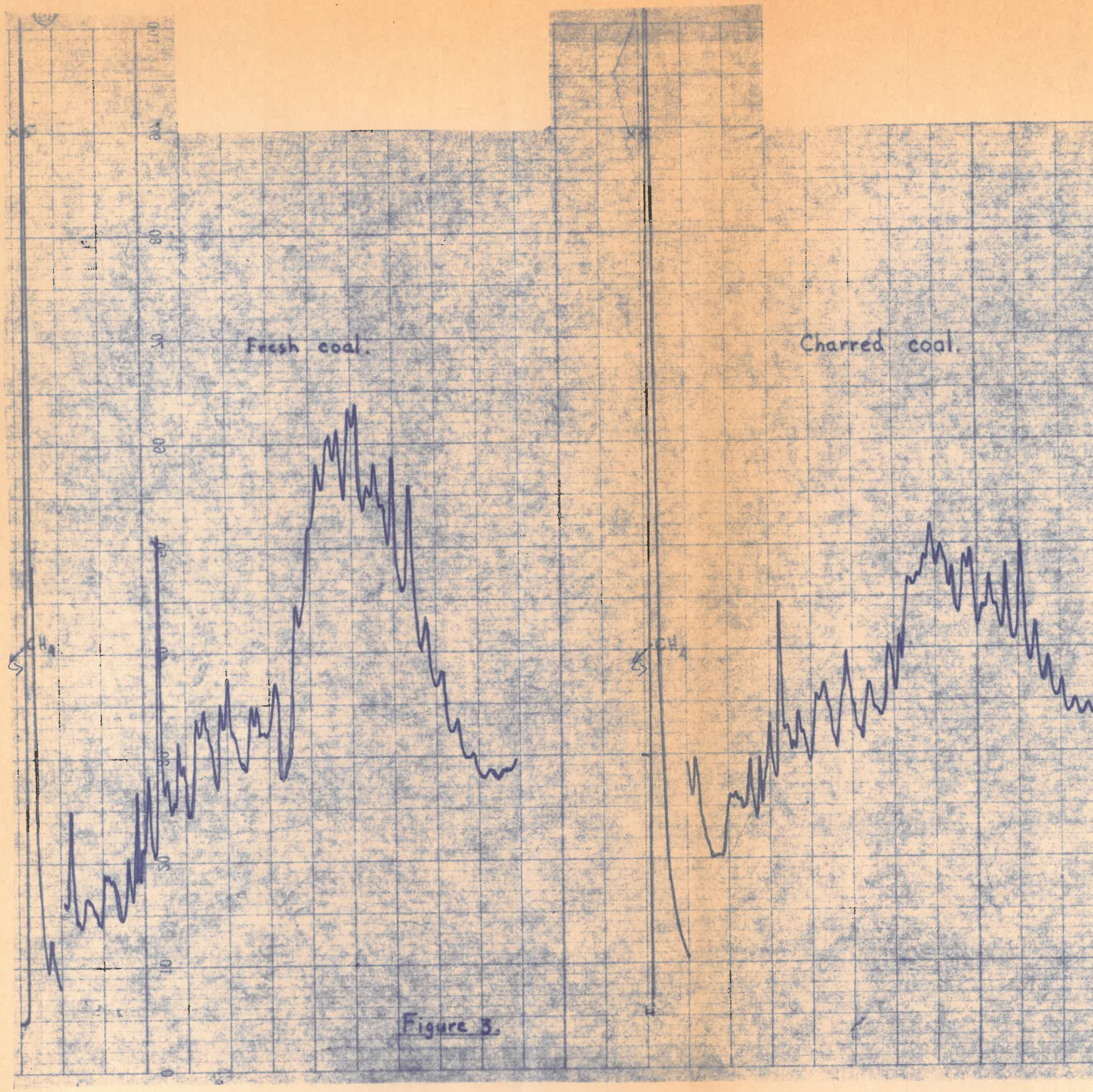


Figure 3.

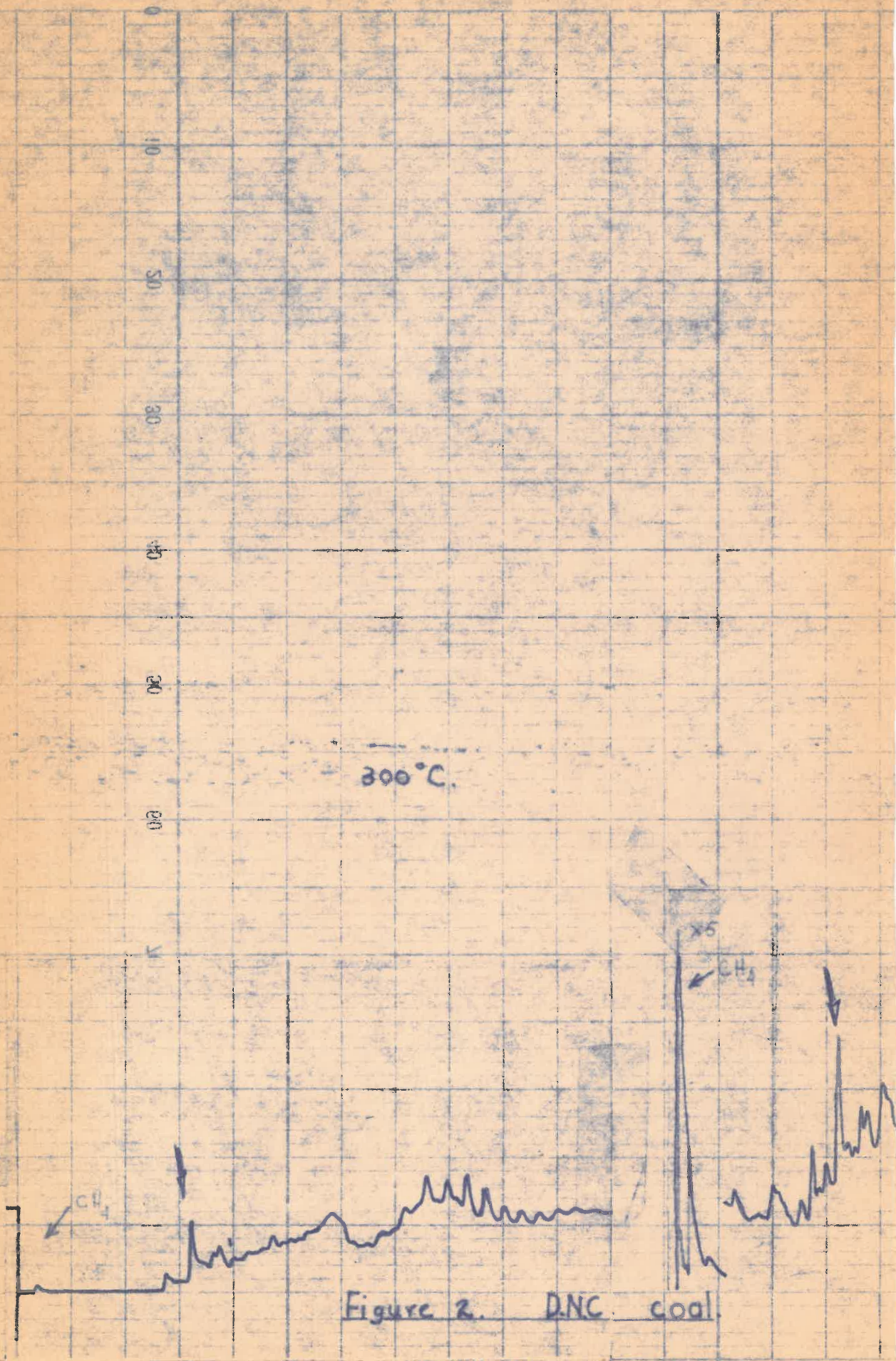
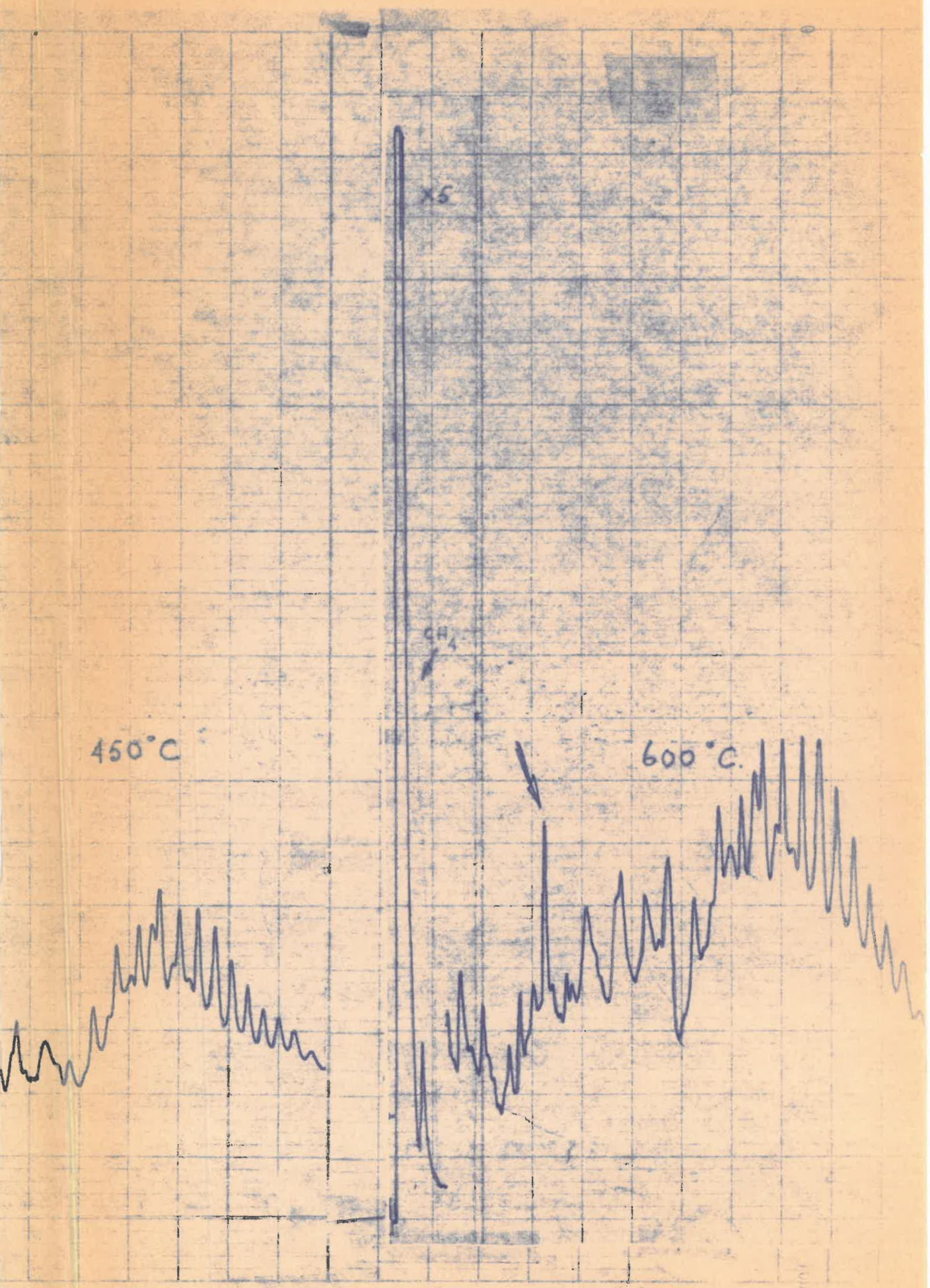


Figure 2. D.NC coal.


x5
CH4
450°C
600°C.

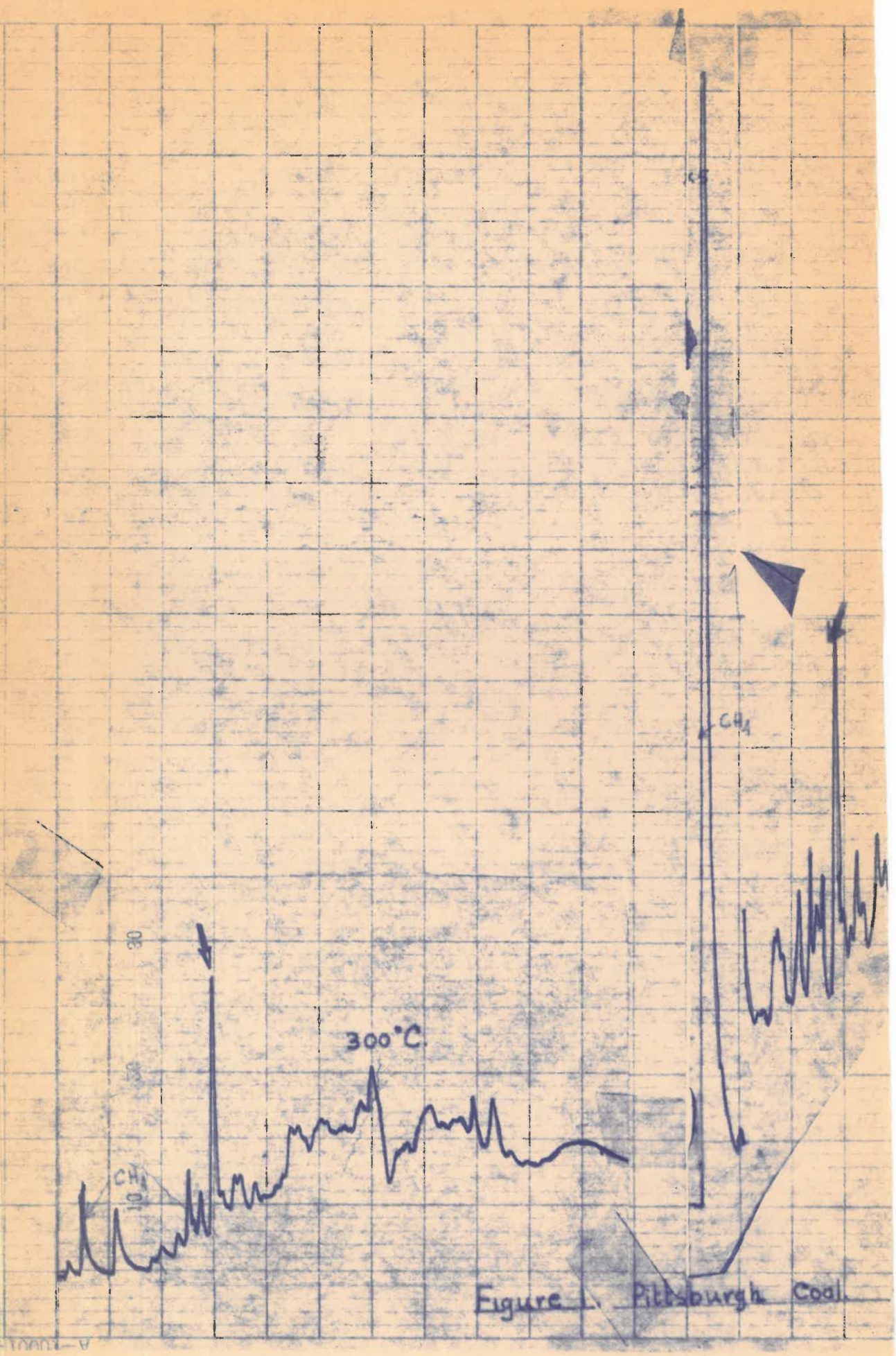
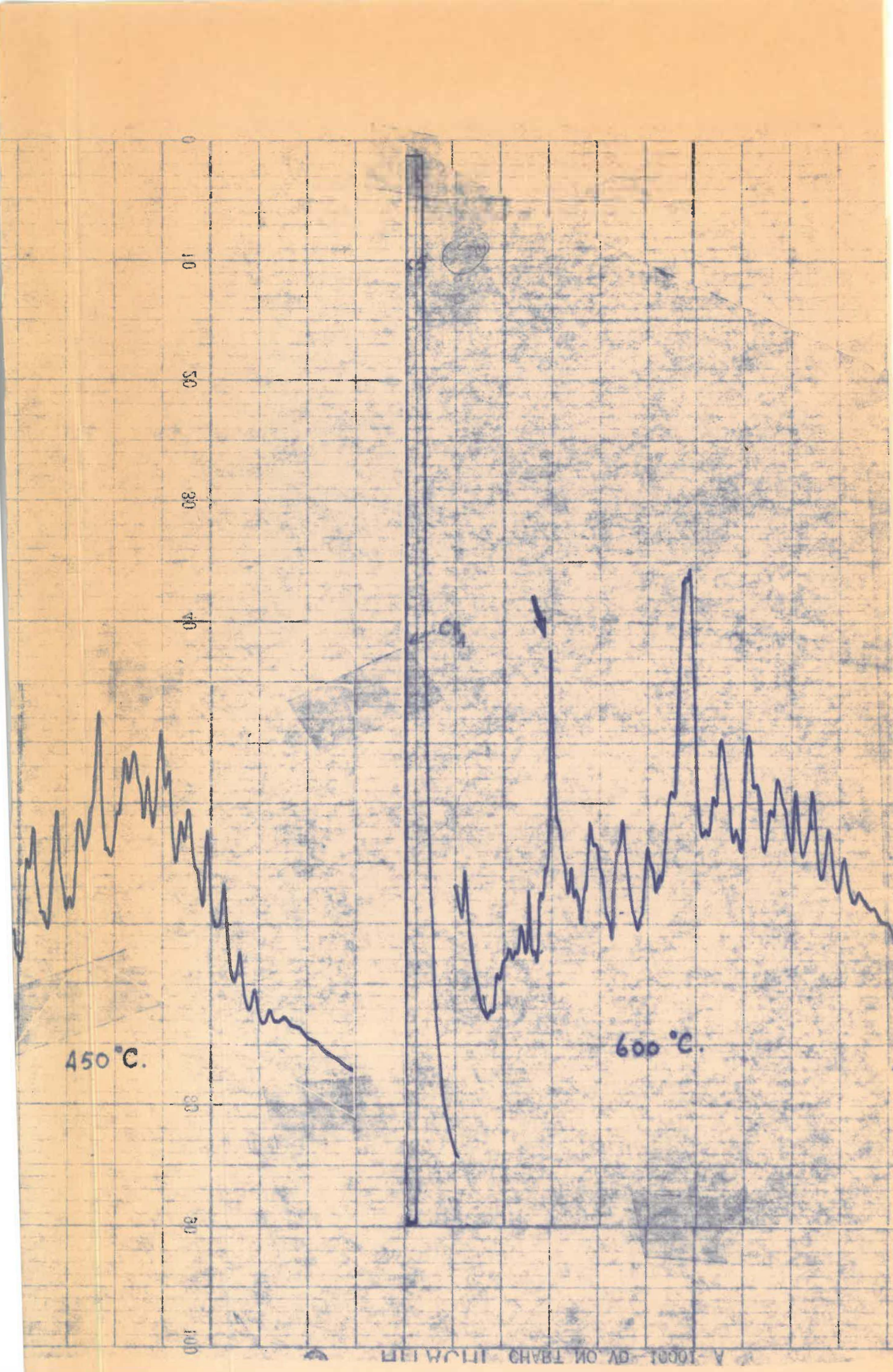


Figure 1. Pittsburgh Coal


CH_4
450 °C.
600 °C.