

REPORT

Industrial Minerals Unit, Department of Geology, Leicester University

The Industrial Minerals Unit forms a significant part of the Applied Geology Group within the Geology Department of Leicester University. It is devoted to the study of mainly non-metallic industrial rocks and minerals, from their geological occurrence through to their evaluation, processing and industrial performance. The aim is to utilise the best basic science to increase wealth generation. The group was first formed in Hull in 1977 to teach an MSc. course in Industrial Mineralogy, which moved to Leicester in 1989, along with the core staff. The MSc. is now renamed "Industrial Rocks and Minerals" and complements the more metalliferous bias of the long-standing Mineral Exploration MSc. also offered in the department.

The MSc. course covers the geology, mineralogy, industrial applications, assessment techniques and deposit evaluation of this vital class of commodities and attracts between seven and 15 UK and overseas graduates annually. As with many other such courses there are only limited funds for supporting UK graduates and selection is competitive. Overseas students come from as far afield as Pakistan, Malaysia, Saudi Arabia, Germany, Nigeria, Malawi and Malta, often bringing a wealth of experience from mature graduates who have been employed by companies or national geological surveys for some time. There is an

ongoing link with Lahore University in Pakistan which will include aid in setting up their own industrial minerals laboratories. Parts of the course are also frequently used as research training for a wide range of petrologically based PhD. projects.

The unit maintains strong links with industry through its past graduates now in post, by obtaining contracts for analyses and through consultancy work. The MSc. student projects also play an important role, usually being undertaken in conjunction with a company investigating specific raw material related problems. Recent projects have been undertaken with Tarmac, Redlands, CAMAS, and Longcliffe, providing invaluable experience for the student and worthwhile data and solutions for the companies.

PhD. Research

The unit also supports a large group of PhD. students, with on-going research into a wide range of subjects including perlite, zeolite, aggregates, nepheline syenite, pillared clays, smectite-illite interlayered clays, bauxites and gemstones. The unit was particularly pleased this year to be approached by CAMAS aggregates with a NERC CASE studentship to study the controls exercised by the basal Triassic unconformity south of Leicester on aggregate availability and performance.

Other research by staff and associates includes fluorite mineralization, alkali silica reactivity in concrete, aggregates, building stones, archaeological mineralogy, clay mineralogy and sedimentary geochemistry.

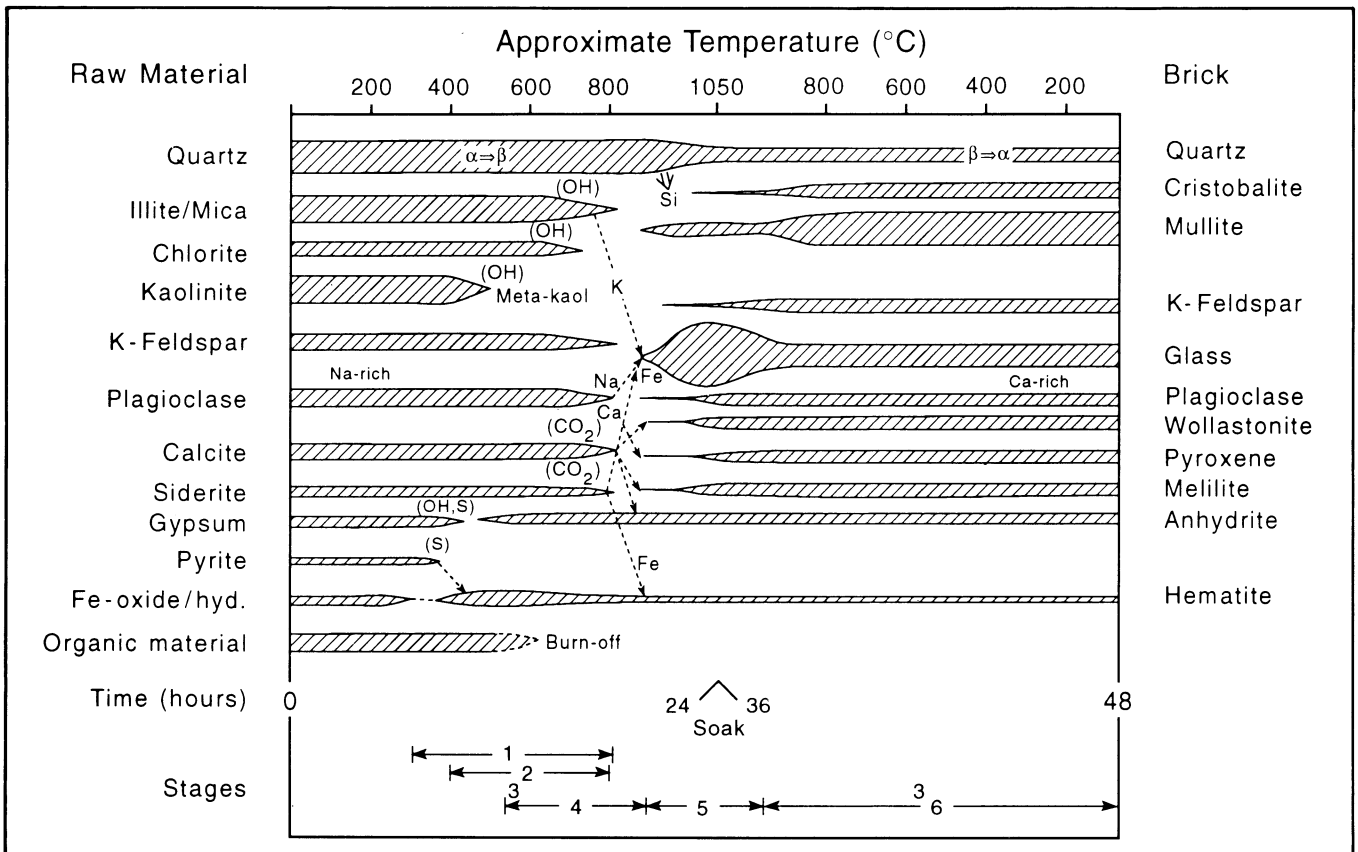


Fig 1. Phase transformation during brick manufacture (reproduced by permission of the Yorkshire Geological Society).

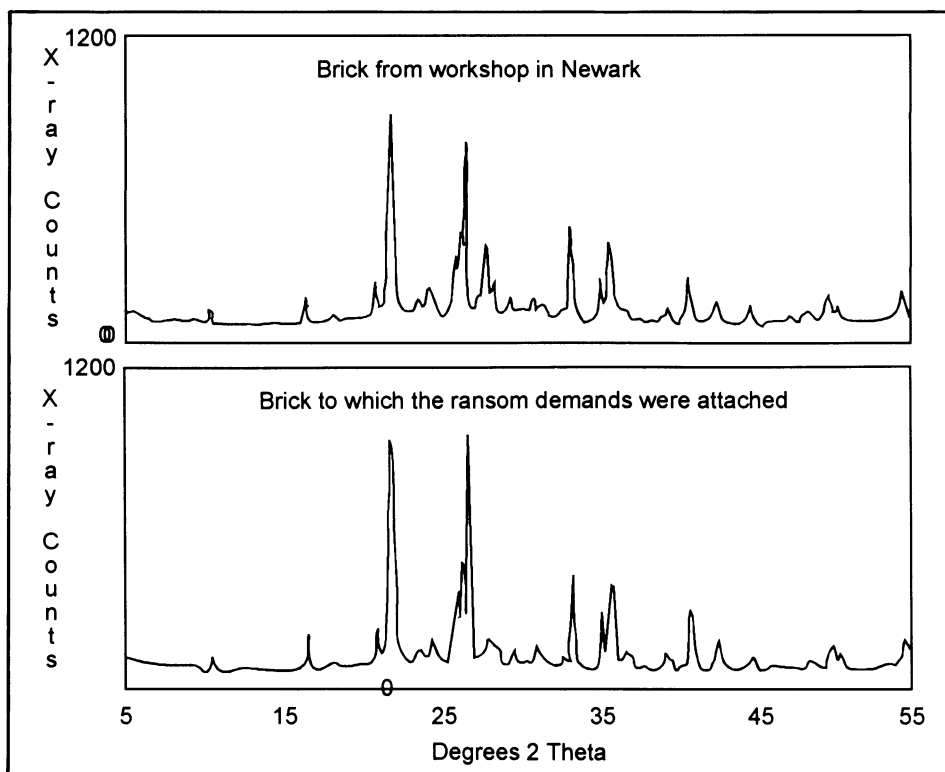


Fig 2. X-ray diffraction traces from the Sams murder investigation.

Gemstones

A new departure for the group is the development of teaching and research in coloured gemstones. Our analytical facilities and research methods complement those used by gemmologists and we are discussing with the Gemmological Association in London a route towards awarding specially prepared part time students an M.Sc in Industrial Mineralogy (Gemmology). Our current research in this area centres on the problems of defining the provenance of rough or cut corundum gemstones (sapphires and rubies). Rarity value, especially for top quality gems, is related to locality and stones are frequently fraudulently passed off as having specific origins. They may also have been treated to improve clarity and colour and we may be able to make the identification of such specimens easier.

Energy efficiency

The unit can also claim its green credentials through work sponsored by MIRO (the Mineral Industries Research Organisation), with the collaboration of the Government Energy Efficiency Office and the brick industry. Sampling and analysis of all the main raw materials used in brick manufacture has been undertaken to document their mineralogical and chemical compositions. All the materials were then fired over a series of different temperatures and for different durations to allow a Time-Temperature-Transformation (TTT) plot to be constructed. This identified the new mineral phases formed during the firing process (Fig. 1) and their stability fields, revealing that in many cases bricks could be fired to the same mineralogical compositions and physical properties at a slightly *higher* temperature but for a much *shorter* time than is currently used. The consequences for fuel economy are of

considerable interest to both the brick manufacturers and the energy authorities.

Forensic mineralogy

The unit made local and national press headlines in 1993 with its work on the Julie Dart murder case. During the kidnap and subsequent murder of Julie Dart the murderer, Sams, left notes taunting the police, weighed down by bricks. As a result of the brick project described above, the unit at Leicester had a database of UK brick composition and mineralogy with which these bricks could be compared. It fortunately transpired that the bricks used by Sams were of a very rare kind and, through collaboration with the technical staff at Steetley, it was possible to identify the source of the raw materials (right down to the individual quarry!) and provide details of the geographical area into which they were sold. When Sams was eventually arrested for the abduction of Stephanie Slater a stock of the same bricks was found at his workshop and these linked him to the Julie Dart case (Fig. 2).

Since that time the unit has continued to "help the police with their enquiries" in connection with other murders and armed robberies. Mr. A. Smith, for example, has analysed several mud samples from boots worn by suspects using XRD methods and, with the aid of a palynological expert, helped to locate the remains of two murder victims near Rutland Water last year.

Kip Jeffrey
Department of Geology
The University
Leicester
LE1 7RH