

## NOTES AND NEWS

### ORIENTED OLIVINE INCLUSIONS IN DIAMOND\*

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According to Sutton (1) and Williams (2) there has been strong evidence for the presence of olivine inclusions in the diamond. These authors, however, indicate that there was not definite proof of olivine being completely enclosed within a diamond.

Recently a number of diamond crystals with interesting inclusions were observed at this laboratory. These were noticed during an investigation of the double refraction of several thousand diamonds of the type known as *flats*. These inclusions are colorless and, in most cases, well developed. They are oriented parallel to the (111) plane and elongated parallel to the [101] direction of the diamond. They exhibit inclined extinction. Due to the orientation of these inclusions within the diamond, it seemed feasible to establish their identity by  $x$ -ray analysis.

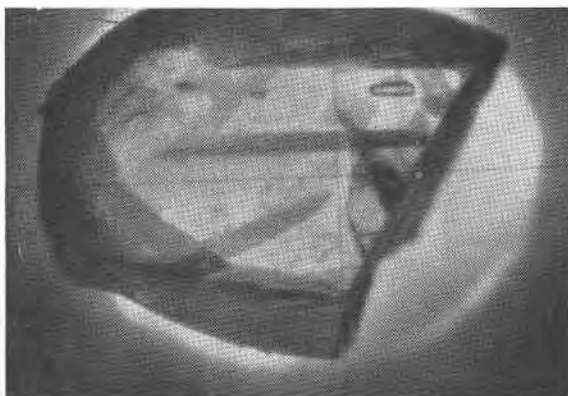


FIG. 1. Diamond *flat* containing three parallel olivine inclusions,  $\times 28$ . Only two of these inclusions are in focus.

Using the direction of elongation of the inclusions (diamond [101]) as the rotation axis, zero and first level Weissenberg, and rotation photographs were made of one of the specimens containing three parallel inclusions (Fig. 1). Since the largest inclusion is isolated at one corner of the *flat*, it was possible to obtain  $x$ -ray patterns from this single inclusion superimposed upon diamond patterns. A study of these films definitely established the identity of this inclusion as being olivine elon-

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gated along its [101] direction. A second diamond containing a similar inclusion was subsequently investigated in the same manner. This inclusion also proved to be olivine with the same elongation.

After the identity of these inclusions was established by *x*-ray methods, an optical check verified this peculiar elongation of olivine and also explained the inclined extinction that was observed prior to the identification of the inclusions. In Fig. 2, lines *a* and *c* correspond to these crystallographic axes which are also the extinction directions. The *b* axis is

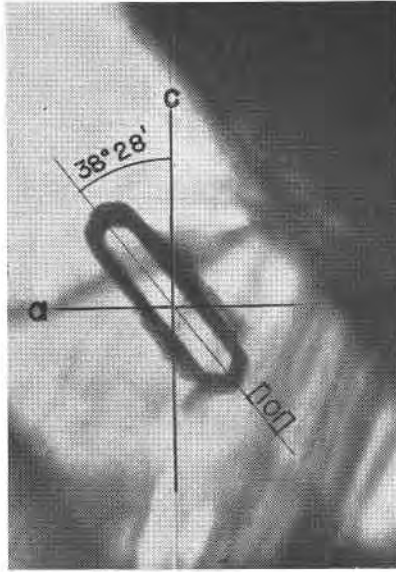


FIG. 2. The largest olivine inclusion of Fig. 1. The *a* and *c* crystallographic axes and elongation direction [101] are indicated.

perpendicular to the (111) face of the *flat* which is parallel to the plane of the photograph. The extinction angles measured against the direction of elongation of the inclusion correspond to the calculated angles between the [101] direction and the *a* and *c* axes of olivine. The observed extinction was somewhat wavy, perhaps due to strain.

Inclusions similar to those described above were noted in a number of other diamond *flats* which were examined. A detailed investigation, however, has not been carried out.

This work was incidental to the general investigation of diamond which is being carried on with the financial assistance of the Office of Naval Research. The writers wish to thank Professor L. S. Ramsdell and Professor C. B. Slawson, of the Mineralogical Laboratory, University of Michigan, for their helpful criticisms and suggestions. The writers

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## REFERENCES

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NOTES ON SOME MINERAL OCCURRENCES IN THE  
GUFFEY REGION, COLORADO\*

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## INTRODUCTION

Most of these mineral occurrences have not been described previously in detail, although a few of them have been reported briefly. The mineral localities here described were studied during the summers of 1950 and 1951 as a part of field investigations leading to the preparation of a doctoral dissertation in mineralogy for the University of Michigan.

The Guffey region is an area of about 125 square miles in north-central Fremont County and southeast Park County in the Front Range of central Colorado. Its center is 34 miles by road northwest of Canon City. The area is underlain chiefly by pre-Cambrian igneous and metamorphic rocks, which have been covered to the north, east and west by post-Laramide extrusive rocks.

On the basis of their geological environments it is possible to classify the mineral occurrences under three headings: pegmatite minerals, minerals of the metamorphic rocks and minerals of metallic ore deposits.

## PEGMATITE MINERAL OCCURRENCES

The pegmatites in the area are pre-Cambrian in age, and probably are associated genetically with the intrusion of the Pikes Peak granite batholith (Bever, 1952).

*Euxenite*: An unusual concentration of this rare radioactive mineral was found in the core margin unit of a small zoned pegmatite about 200 feet west of the Mac Gulch drainage, approximately 3 miles southeast of Guffey. The euxenite occurs in bladed crystals as much as 2 centimeters in length, whose freshly broken surfaces are glassy and brownish-black in color. Associated are abundant coarse biotite and magnetite as well as the other common granitic pegmatite minerals. Tantalite also is

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