of 38 to 40. The threads on the bomb nut should be loose-fitting and well lubricated to prevent galling.

The pressure vessel is mounted in a vertical position with the closure at the bottom, and the samples are placed in a small cup supported by a steel rod. The pressure vessel is heated by a resistance furnace with $1\frac{1}{2}$ inch internal diameter. The furnace is mounted in such a way that it can be removed from the pressure vessel at the end of a run and the vessel can be quenched by directing a stream of air against the hot portion. An annular ring with perforations on the inside is supported at the bottom of the furnace and automatically comes into the correct position for quenching when the furnace is raised from the pressure vessel. Raising the furnace and turning on the air for quenching is carried out by remote control.

Temperature is measured by chromel-alumel thermocouples, one placed in the well in the pressure vessel, and a second outside the well just above the bomb for controlling the temperature of the furnace. Pressure is measured by a Harwood manganin cell, whose output is measured and continuously recorded by a Foxboro Dynalog Recorder. The highest pressure that has been used with this device is 11,000 bars at 750° C. Runs up to one week at 740° C. at 10,000 bars are routine.

Initially, the pressure vessels were machined from 1 inch stock,but after several runs in the range 700–750° C., a number of them failed. We have had no failures with the $1\frac{1}{4}$ inch pressure vessels.

The principal advantage of this type of apparatus is the low cost of operation and the relative simplicity. One can operate this pressure vessel, or a series of these pressure vessels, at a fraction of the cost of internally heated pressure vessels.

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THE GROOVED PLATE, A SIMPLE PETROGRAPHIC AID FOR SIZE MEASUREMENTS OF ELONGATE MINERALS[1]

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Introduction

The increasing use of data derived from measurements of elongate grains, such as zircon crystals, has created a need for techniques that permit the rapid measurement of a statistically significant number of grains. By use of the method to be described, wherein the grains are first aligned by means of a grooved plexiglass plate and then measured with

[1] Publication authorized by the Director, U. S. Geological Survey.

an ocular lens equipped with a net micrometer, lengths and widths of as many as 200 grains have been conveniently measured in half an hour.

Construction of the Grooved Plate

A 1 by $1\frac{1}{2}$ by $\frac{1}{8}$-inch clear plexiglass plate is grooved with a $\frac{1}{4}$-inch four fluted end mill. The end mill is rotated 45° to the plate before cutting. The plate is raised 0.015-inch and moved $\frac{3}{4}$-inch along its width. Successive parallel grooves are cut by displacing the plate at 0.03-inch intervals along its length (Fig. 1).

Procedure for Use

Several drops of refractive index oil equal to that of the plexiglass ($n = 1.4885 \pm .0005$) are placed on the grooved plate. The minerals to be measured are evenly sprinkled into the oil. Then the plate is tilted parallel to the grooves and gently tapped, causing the excess oil to wash the overlapping minerals down the grooves, thereby automatically aligning the minerals. A net micrometer which is appropriate for the magnification desired and the grain size to be measured is placed in the ocular and calibrated. The plexiglass plate is moved parallel to the grooves with a mechanical stage, allowing quick measurement of lengths and widths (Fig. 2).

This procedure minimizes rotation of the microscope stage and keeps the grains well centered and aligned at all times for rapid successive measurements. It also eliminates the possibility of subconscious selection of the grains to be measured, such as may arise when randomly oriented grains are used, and the possibility of repeated measurements.

Grains are easily recovered from the plate by washing with nonabrasive soap and water. Care should be taken not to use concentrated

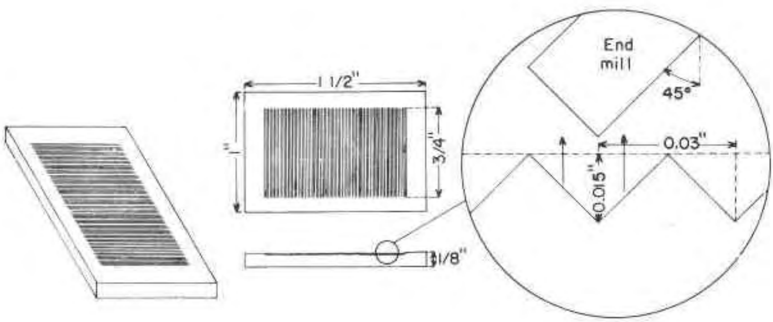

Fig. 1. Sketch of the grooved plate. Enlargement at right shows position of end mill for cutting grooves.

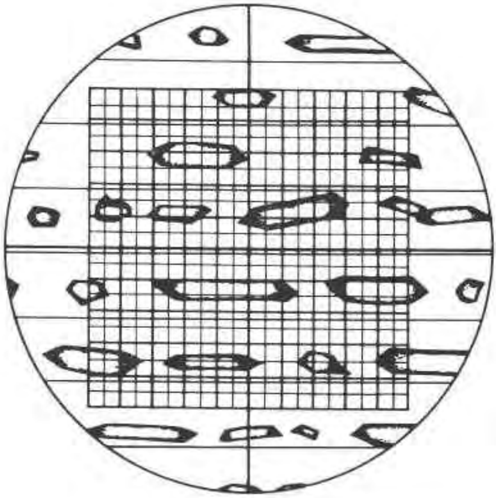

FIG. 2. Orthoscopic view of aligned minerals ready for measurement.

alcohols, benzene, acetone, or carbon tetrachloride for cleaning because they will soften the plexiglass surface.

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CALCIFEROUS BROWN AMPHIBOLE IN ALKALIC GABBRO OF KORAPUT, ORISSA, INDIA

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INTRODUCTION

Mineralogical interest associated with brown amphibole is out of all proportion to its frequency of occurrence. The limited occurrence of such amphiboles obviously reflects restricted conditions for their development. The recent significant contribution by Wilkinson (1961) furnishes the long needed comparative study of the calciferous brown amphiboles and offers a quantitative basis for distinguishing barkevikite from kaersutite—the latter was so long vaguely defined as a titaniferous brown amphibole.

OCCURRENCE

Brown amphibole occurs as the dominant constituent in an alkali gabbro sheet at Koraput, Orissa. The other significant coexisting mafic silicate is a titaniferous salite—a characteristic pyroxene of alkali olivine-basaltic magma (Wilkinson 1956). The constituent plagioclase in the rock is intermediate andesine commonly clouded with minute inclusions.