A New Occurrence of Beryllium Minerals on the Seward Peninsula, Alaska

By C. L. Sainsbury

U.S. GEOLOGICAL SURVEY OPEN FILE REPORT

MENLO PARK, CALIFORNIA

Paper presented at the AIME meeting in Anchorage, Alaska, April 26-28.

A new occurrence of beryllium minerals on the Seward Peninsula, Alaska

Abstract

Beryllium in the form of chrysoberyl was found at a new locality on the public domain on the Seward Peninsula. The beryllium is associated with altered dikes and marmorized limestone veined with fluorite-tourmaline-chrysoberyl veinlets. Although the chrysoberyl is fine grained and intergrown intricately with the fluorite and tourmaline, it has been separated and identified by X-ray diffraction. Specimens of ore selected randomly from areas of fluoritized limestone contain beryllium in the range .01 to 3.3 percent BeO. The area warrants detailed mapping and sampling, which will be done by the U.S. Geological Survey in 1962.

INTRODUCTION

History of beryllium on the Seward Peninsula

The first reference to beryllium minerals on the Seward Peninsula, Alaska, appeared in U.S. Geological Survey Bulletin 533, published in 1913, in which Fred H. Moffit mentioned beryl in a dike at North Star Creek, north of Nome. Since that time brief mention has been made of beryllium minerals associated with the tin deposits at Lost River, Cape Mountain, and Ear Mountain, mostly in published and unpublished reports of the U.S. Bureau of Mines and the U.S. Geological Survey that deal with the Lost River mine. During exploration of the Lost River deposits in 1940-44, a cooperative

Present investigations

The present investigation by the U.S. Geological Survey began in the fall of 1959 when G. Donald Eberlein and Wallace R. Griffitts, who, as a Survey geologist had been investigating the beryllium at Spor Mountain in the Thomas Range, Utah, discussed the Seward Peninsula in terms of the new interest in beryllium and the known widespread occurrence of beryllium on the western Seward Peninsula. Information assembled by P. L. Killeen and the writer was studied, and a program laid out which consists of four steps, as follows:

(1) A geochemical reconnaissance by use of stream sediments of the three principal tin districts at Lost River, Cape Mountain, and Ear Mountain, to outline the areas of greatest concentration of beryllium.

(2) Detailed geologic mapping of the Lost River area to determine the geologic setting of the known tin-tungsten-beryllium deposits, and to establish the stratigraphy of the Port Clarence limestone.

(3) Geologic mapping by plane table of unmapped mineralized areas at scales commensurate with detail required.

(4) Laboratory studies of the mineralogy of the beryllium-bearing minerals, and to a lesser extent of the tin and tungsten minerals.

The tin and tungsten mineralization had been described by Collier (1903), Knopf (1906), and Steidtmann and Cathcart (1922), and the relations between the tin-tungsten mineralization and the clay alteration by the writer (Sainsbury, 1960). Hence, our information about the tin and by ascending Rapid River to the point where it turns north and is joined by a tributary which enters from the east in a sharp gully. Light aircraft can land on a crudely marked airstrip some 800 feet long at the southern end of the prospect area. This strip was used by the writer during the field work in 1961.

Geology

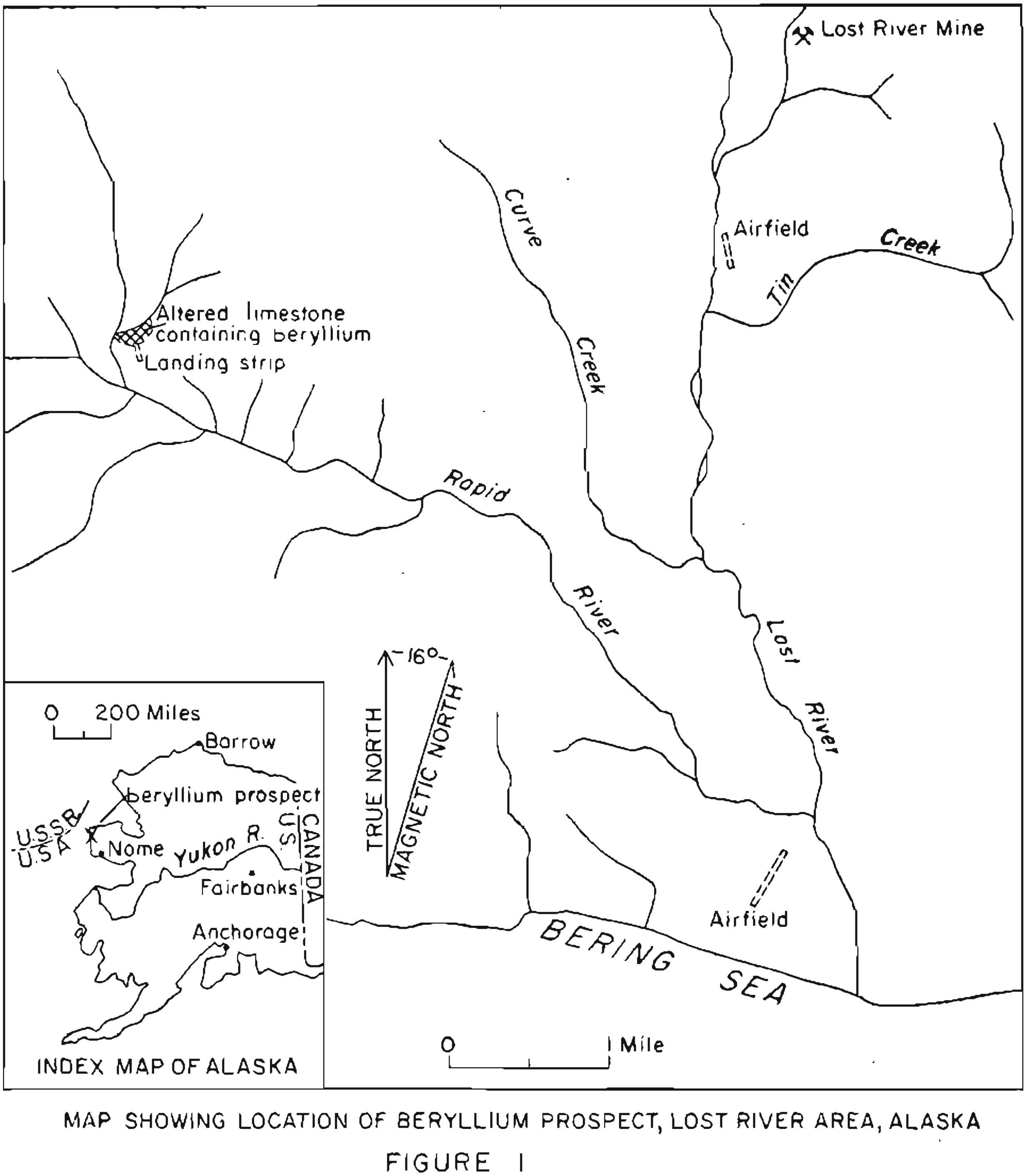
At the prospect, argillaceous limestone of the Port Clarence Formation is cut by a number of discontinuous dikes averaging perhaps 3 feet thick that are intruded along or near a fault that strikes about N. 80° E. and dips steeply south. The generalized geology of the prospect area is shown on figure 2. The dikes are dark gray on fractured surface and brownish gray on weathered surface. Some segments of the dikes are intruded along well-defined joints striking N. 80° W. and dipping 54° N. The dikes are altered and contain carbonate and sulfide minerals; they were probably quartz diabase originally. In thin section they display a marked trachytic or diabasic texture with fine-grained plagioclase feldspar and biotite surrounding phenocrysts of plagioclase and quartz. The carbonate probably represents altered pyroxene.

The limestone over an area some 2,000 feet along the fault and up to several hundred feet wide south of the fault locally is converted to white marble and cut by innumerable small veinlets containing fluorite, tourmaline, topaz, calc-silicate minerals, and chrysoberyl, and by siliceous veinlets. Banded fluorite-tourmaline-chrysoberyl rock forms discontinuous selvages up to 8 inches thick along dike walls, and on the from float of fluoritized limestone, and of one specimen of banded fluorite-tourmaline rock from the dike walls, as determined by the neutron detector for beryllium, ranges from .01 percent to 3.3 percent BeO. The specimens of float averaged 1.2 percent BeO (1.34 percent BeO if the lowest value is excluded). The single specimen of fluoritized limestone from the dike walls contained 0.45 percent BeO. Semi-quantitative spectrographic analyses of one specimen was made by Harry Bastron of the U.S. Geological Survey in Menlo Park, California, and confirmed the high beryllium content. As five specimens of silicified limestone contain only trace amounts of BeO it appears that the fluoritized limestone is more likely to contain beryllium ore. It has proved impossible to date to determine how much of the beryllium is accounted for by chrysoberyl, and how much might be contained in the tourmaline, owing to the fine-grained intergrowth of the two. Undoubtedly some of the beryllium, but probably a minor part, is contained in the tourmaline and hence unrecoverable without chemical digestion. X-ray diffraction patterns made of pieces of the selected specimens that were leached in $AlCl_3$ disclosed peaks characteristic of chrysoberyl, however. It is interesting to note that banded fluorite-tourmaline-tactite rock from the Lost River mine is very similar to that at Rapid River, and also consistently carries beryllium (Sainsbury, 1961).

The data collected to date do not provide enough evidence to estimate the amount of ore of economic grade that might be found in the Rapid River area. It is clear, however, that beryllium is an contacts, and electronics components. It is of importance in nuclear reactors, where it is used as a reflector and moderator of neutrons to control the speed of fission. The metal is light in weight, it has a high strength-to-weight ratio, an unusual stiffness, a high thermal conductivity and heat capacity, and a high melting point, all of which favor its use in the aircraft and missile industry. The use of beryllium has expanded greatly in recent years, and if adequate sources of supply are established, it should continue to expand. Most of the supply of beryllium used in the United States comes from imported ores, and the discovery of commercial-grade deposits in the United States is of prime importance from both a technologic and strategic viewpoint.

In summary, we may state that beryllium has been found at many places in the tin districts of the western Seward Peninsula. At two places, Lost River mine and Rapid River, material of ore grade has been found. The aggregate amount of beryllium already found is substantial in terms of the total domestic supply, and will probably increase with continued exploration. Whether minable tonnages of commercial grade ore will be found can be answered only after detailed geologic mapping and careful physical exploration. Because the beryllium ores at Rapid River and Lost River are associated closely with tin, tungsten, and fluorite, all of which are valuable and which are recoverable, these deposits merit careful scrutiny by both private industry and government.

The Geological Survey plans to continue detailed geologic mapping and sampling of the Rapid River prospect in 1962.



MAP SHOWING LOCATION OF BERYLLIUM PROSPECT, LOST RIVER AREA, ALASKA

FIGURE 1

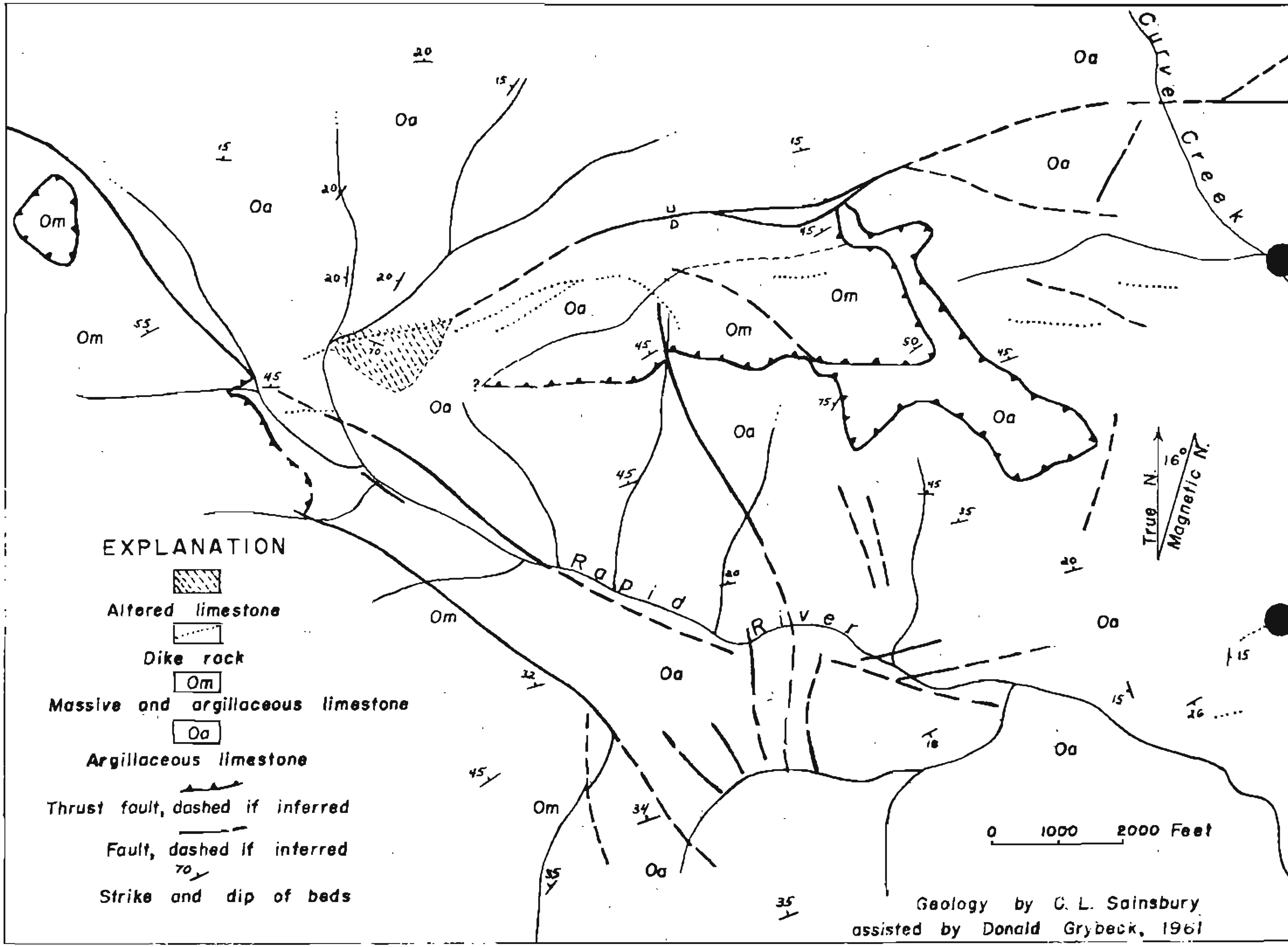


FIGURE 2 GEOLOGIC MAP OF PROSPECT AREA ON RAPID RIVER

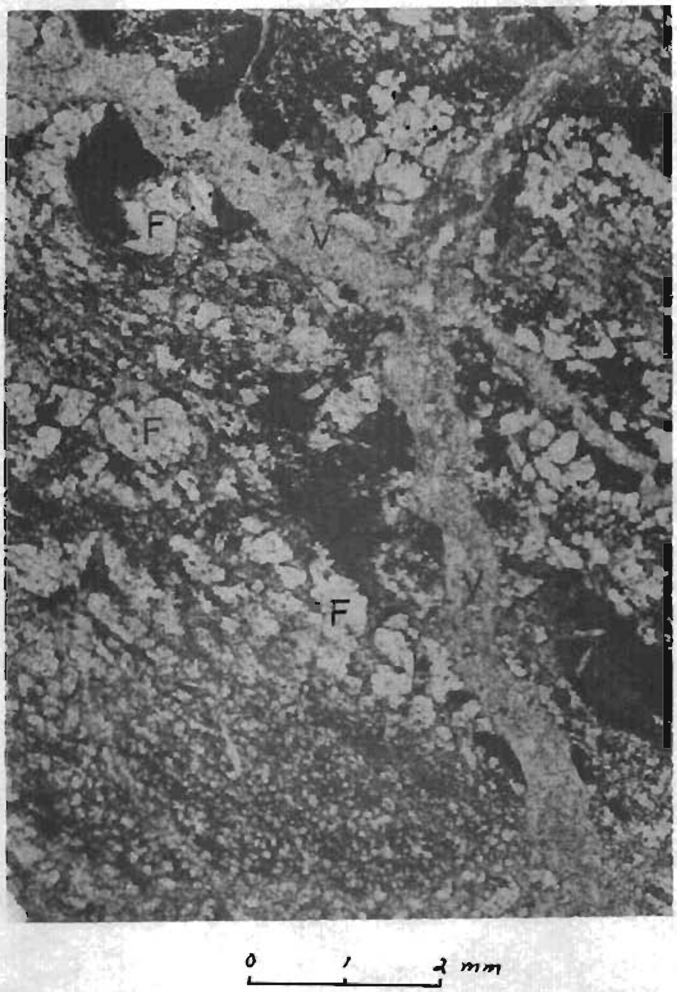


Figure 3. Photomicrograph of beryllium ore from Rapid River. Shows late tourmaline-chrysoberyl veinlet (V), which cuts fluorite-tourmaline-chrysoberyl intergrown intimately. Curdy chrysoberyl is dark, and fluorite forms larger, clear grains (F). Uncrossed nicols.

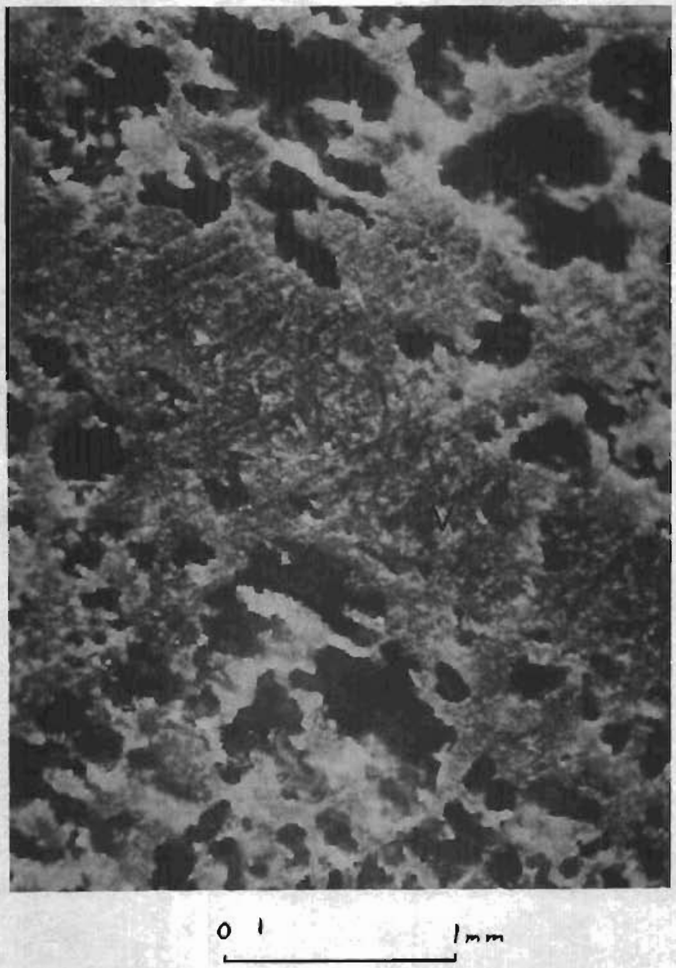


Figure 4. Slab of chrysoberyl-tourmaline-fluorite rock from Rapid River after leaching in aluminum chloride to remove the fluorite. Mineral remaining is tourmaline in veinlet (V), and chrysoberyl intergrown with tourmaline in other areas. Photomicrograph taken in oblique light.