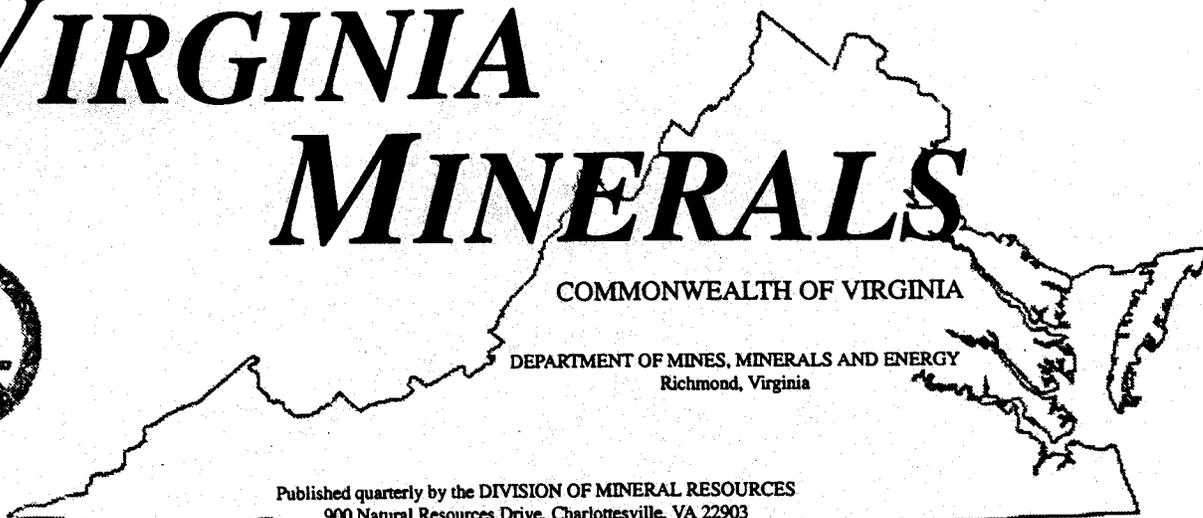


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DIAMONDS IN VIRGINIA

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INTRODUCTION

Five diamonds have been found in or near Virginia and two additional sites may offer some potential for diamond exploration (Figure 1). The five diamonds were found in Chesterfield (City of Richmond), Orange, Spotsylvania, and Tazewell Counties, Virginia and Monroe County, West Virginia. It is noted by Holden (1944) that the Stephenson (1878) report stated that several valuable diamonds have been found in Virginia, one of more than forty carats, was found in a farmer's desk, after his death. The two sites that may offer some economic potential are the Mount Horeb kimberlite in Rockbridge County and a mica peridotite dike in Warren County.

SOURCES

Of the three sources of diamonds: kimberlites, lamprophyres, and placer deposits, kimberlites are the primary source. They are derived from the melting of rocks that compose the earth's mantle. Kimberlites are usually dark green in color and composed mainly of the silicate minerals olivine, serpentine, mica, and pyroxene with accessory calcite and iron-titanium oxide minerals. Kimberlites occur in geologic settings where the earth has been tectonically inactive for millions of years (Pasteris, 1983). Kimberlite is produced when peridotite (dark intrusive rock) melts at differ-

ent levels in the earth's upper mantle. Initial melting may occur at depths of 150 to 200 kilometers where temperatures are over 800° Centigrade and pressures are greater than one million pounds per square inch. With the right combination of enormous pressures and temperatures of 925 to nearly 1260 degrees Centigrade, carbon atoms from diamond crystals (Bruce, 1995). The peridotite melt is practically a liquid and allows carbon (C) atoms to freely move and form diamonds. Dating of zircons, that are commonly inclusions in diamonds, provides a Precambrian age (older than 550 million years) and indicates that the diamonds have been flowing around in the mantle for a very long time (Sweet, 1994).

Major diamond deposits occur in "pipes" or diatremes that branch toward the surface (Pasteris, 1983). A diatreme may consist of several intrusions of kimberlite and may have erupted like a volcano. As the kimberlite melt rises, it captures fragments of surrounding rocks, which are carried along with the intrusive; crystallization also takes place toward the surface which changes the chemistry of the melt and the end product may be entirely different from the composition of the original melt in the mantle. Although kimberlites are the main source rock for diamonds, only about five percent of known kimberlites contain diamonds. The richest kimberlites thus far discovered in South Africa have concentrations on the order of two parts per million or about 20 to 30 carats

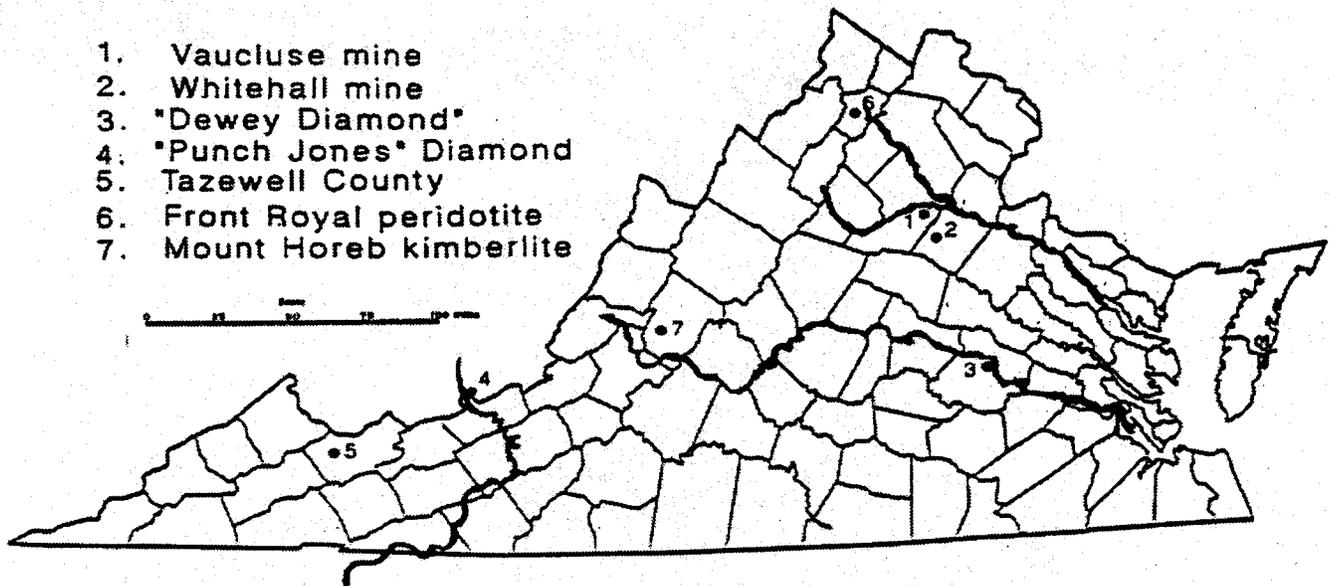


Figure 1. Location of diamonds and potential exploration sites in Virginia.

of diamonds per 100 tons of rock (Pasteris, 1983; Sweet, 1994).

A second diamond source includes mafic and ultramafic rocks, such as lampophyres, present in North America in a belt of rocks extending from Alabama to eastern Canada. Lampophyres are dark dike rocks containing biotite, hornblende, olivine, and sometimes pyroxene. The dark minerals occur as phenocrysts and in the groundmass. Minerals in lampophyres are commonly altered to chlorite and calcite.

A third occurrence is the alluvial or placer type where diamonds were deposited by streams or rivers that drain regions where kimberlites or lampophyre rocks occur. Gravels weathered from these types of rocks have yielded diamonds in Virginia and several other eastern states (Wilson, 1948). The specific source of the Virginia diamonds is still unknown as it is usually difficult to trace a given deposit to its bedrock source. Gold (1984) states that of the 300 tons (1.5 billion carats) of diamonds recovered to date, most have come from alluvial deposits.

In exploration, indicator minerals usually eroded from the kimberlite, include reddish-pyrope garnet, dull-hued chromite, picroilmenite and bright green diopside. During exploration in the Northwest Territories of Canada, in the late 1970s, garnets, chromite, and other indicator minerals with subtly different chemical signatures, were determined to be present in diamond-bearing kimberlites but were

absent in barren kimberlites (Krajick, 1994). These minerals were 'G10' garnet which is lower in calcium (under 4 percent) and higher in chromium than other garnets and chromite, with 62.5 percent or more chromium. It was also observed that when iron in ilmenite was highly oxidized, a kimberlite contained virtually no diamonds; iron took on more or less oxygen in response to higher temperatures and available oxygen in the magma. In a highly oxidizing environment diamonds oxidize to form carbon dioxide gas. 'G10' garnets and chromite determine how many diamonds enter the kimberlite and the Cr_2O_3 : MgO ratio of the picroilmenite in a reducing environment determines how many survive (Bruce, 1995; Hausel, 1996).

VIRGINIA DIAMONDS

There have been five diamonds found in or near Virginia and there are at least two sites that warrant further exploration. The five diamonds are the "Dewey Diamond", found in present-day Richmond; a diamond from the Vaucluse gold mine in Orange County; a diamond from the Whitehall gold mine in Spotsylvania County; a diamond from a garden near Pounding Mill in Tazewell County; and the "Punch Jones" diamond found near Rich Creek, in Perterstown, West Virginia. The two sites that may offer some economic potential are the Mount Horeb kimberlite in Rockbridge County and a mica peridotite dike in Warren County.

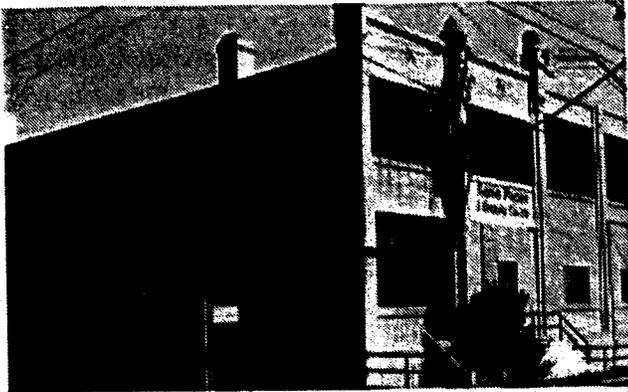


Figure 2. Northeast corner of Ninth and Perry Streets, where the "Dewey Diamond" was found in 1854, in the City of Richmond.

DEWEY DIAMOND - CITY OF RICHMOND

The "Dewey Diamond" (Manchester Diamond), was found at the southwestern corner of Ninth and Perry streets in Manchester (now a part of the City of Richmond), in the floodplain of the James River, by Benjamin Moore, a laborer (Figure 2). Mr. Moore was leveling a hill at this location in 1854 and found the 23.75 carat diamond in the soil (Green, 1982). M.C. Gilbert (1982, written communication) states that this diamond could have originated from the Mount Horeb kimberlite in Rockbridge County, as it is in the James River drainage basin.

The diamond was taken to a jeweler in Richmond, across the James River, and appraised at a value of \$4000 however Mr. Moore sold it to Captain Samuel W. Dewey, a geologist and mineralogist from Philadelphia for \$1500. The first account of the diamond was published in the April 18, 1855 issue of the "New York Evening Post", where it was called the "Dewey Diamond" after Captain Dewey and was described as the "largest diamond found in North America." Dietrich (1990) states that the diamond also was referred to as the "Manchester" diamond. As noted by Kunz (1890), the diamond was described by John H. Tyler as an octahedron with slightly rounded faces having a large flaw on one side. Watson (1907) described the color of the diamond as "faint greenish-white with perfect transparency, but the refraction was somewhat impaired by a flaw or speck in the interior." Green (1982) notes a newspaper account from 1935 describing the stone as "a rather pretty pebble about the size of a hickory nut." In 1855, Dewey, attempting to eliminate the imperfection, had the diamond cut by the firm of H.D. Morse in New York City at a cost of \$1500, which reduced its size from



Figure 3. Glass copy of the "Dewey Diamond" at the Smithsonian Institution, Washington, D.C.; photograph courtesy of the Smithsonian Institution.

the original weight of 23.75 carats to 11.15 carats. Sinkankas (1959) noted that "when cut, the gem proved off-color and imperfect and was worth considerably less than the cost of cutting alone." Watson (1907), states the weight of the cut diamond to be $11 \frac{11}{16}$ (11.69) carats. Later, probably in the late 1850s, the diamond was sold to John Morrissey, a prize fighter in the days of bare fists, for \$6000. Morrissey, who became the American heavyweight champion in 1858 when he defeated John Heenan, had the diamond set in a ring. He retired from the ring and operated luxurious gambling houses in New York and served two terms in Congress (Green, 1982). Morrissey, as the last owner of the diamond on public record, died in the late 19th century. It was reported that exact glass copies of the Manchester Diamond, as it was found and as cut, are in the U.S. Mint Museum in Philadelphia, Pennsylvania and at the Peabody Museum of Natural History in New Haven, Connecticut (Watson, 1907). Telephone calls to both museums in 1995 were fruitless as no glass copies were on display and no records were available. Green (1982) states that a glass copy of the stone is also in the Smithsonian Institution in Washington, D.C. (Figure 3). According to Holden (1944), there is also a model of the diamond in the Field Museum of Natural History, Chicago, Illinois.

VAUCLUSE MINE - ORANGE COUNTY

In eastern Orange County, north of the end of State Road 667 is the site of the abandoned Vacluse (Orange-Grove) gold mine where a "diamond of the first

water" was reported to have been found in gold washings in 1836 (Figure 4). The same reference noted that since there was no "lapidary at hand", the diamond's real value was never ascertained (Anonymous, 1847a). In 1847, the diamond reportedly remained in the possession of the proprietor (Thomas H. Boswell and William H. White were proprietors in March, 1835) (Anonymous, 1847b)

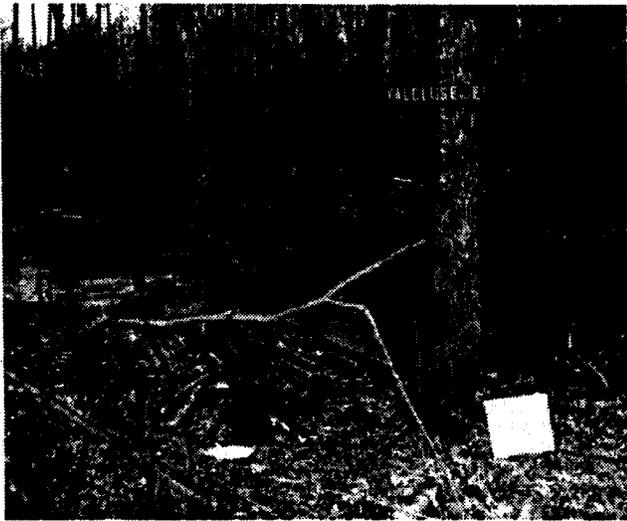


Figure 4. Drainage where a diamond was found "in washings" in 1836 at the Vacluse gold mine in Orange County.

WHITEHALL MINE - SPOTSYLVANIA COUNTY

Stephenson (1878) notes that Mr. G. W. Featherstonhaugh, an English geologist, found a diamond at the Whitehall mines in west-central Spotsylvania County, north of State Road 608. Mr. Featherstonhaugh was also the editor of the *Geological Magazine of Philadelphia* (*The Virginia Herald*, 1833). Holden (1944) states that Stephenson (who found a diamond in Burke County, North Carolina after 1843) was an assayer at the U.S. Mint at Dahlonega, Georgia and had considerable experience in placer gold mining.

TAZEWELL COUNTY

In 1913, a diamond was found by Frank Brewster, a laborer, in a cornfield, "200 feet above a local stream bed", in Tazewell County, on the farm of J.S. "Straws" Gillespie, located about 3 miles east-northeast of the intersection of Pounding Mill Branch Road (State

Road 637) with U.S. Highway 460 in Pounding Mill (Figure 5). Mr. Gillespie's daughter Ollie was in the cornfield at the time and has said that the stone was rough and unimpressive (O.M. Gillespie, 1995, personal communication). Mr. Brewster carried the stone around in his pocket for about a year before he sold it to H.W. Pobst, a jeweler in Tazewell, Virginia, who had it cut by J.R. Wood and Sons of New York. H.W. Pobst's son, Tom, said that the stone was a beautiful blue color and also noted that Wood had declared it to be a genuine diamond. Mr. Gillespie acquired the diamond before he passed away around 1920. According to Holden (1944), who described the diamond as a blue-white stone, no more stones had been found at this site in the following 30 years of searching. Sinkankas (1959) states that the diamond was cut into a gemstone that weighed 0.83 carat. The diamond has been set in a ring and remains in the Gillespie family (O.M. Gillespie, 1995, personal communication).



Figure 5. Site where a diamond was found on the J.S. Gillespie farm in 1913, near Pounding Mill, Tazewell County.

"PUNCH" JONES DIAMOND - MONROE COUNTY, WEST VIRGINIA

In April, 1928, a diamond that was even larger than the Dewey Diamond was discovered (Figure 6). This diamond known as the "Punch" Jones Diamond was found along Rich Creek, in Peterstown, West Virginia, less than one thousand feet from the Virginia State line. It is believed that the diamond was actually from a source in Virginia, North Carolina or Tennessee and washed down the New River into Rich Creek. Holden (1944a,b) noted that due to the abundance of "carry impact markings" and the size of the stone, it had prob-

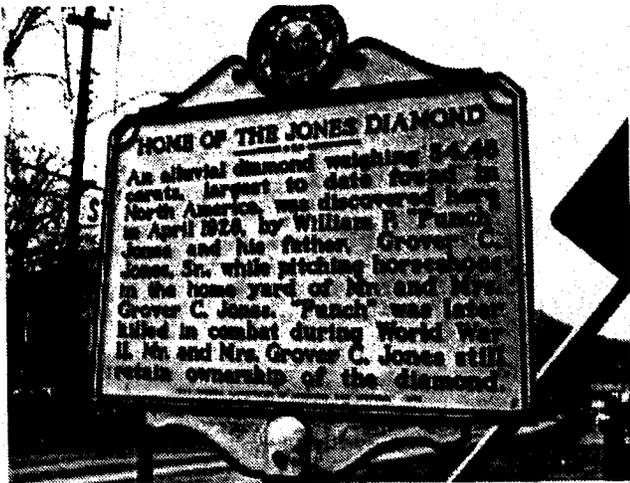


Figure 6. Historical marker for the "Punch" Jones diamond along Rich Creek, Peterstown, West Virginia.

ably traveled a long and violent journey. The diamond measured 5/8 inch across with 12 diamond-shaped faces, weighed 34.48 carats (Holden, 1944b, notes the weight as 34.46 carats) and was the largest found in North America at the time of its discovery.

The bluish-white diamond was found by William P. "Punch" Jones and Grover C. Jones, Sr., while pitching horseshoes, in their yard in April, 1928. "Punch" noticed a bright object when a horseshoe rang in the pit; he picked up a rounded, "glassy mass of striking brilliance, about 3/4 inch in diameter" (Figure 7). In 1942, "Punch" Jones, then 26 years old, asked his father about the stone that they had found fourteen years earlier. It had been stored in a wooden cigar box, stashed in a toolshed (Figure 8). After "Punch" convinced himself the diamond was genuine, he contacted Roy J. Holden, a geology professor at Virginia Polytechnic Institute in Blacksburg on May 5, 1943. After Holden authenticated the diamond, it was sent to the Smithsonian Institution by Jones for safekeeping and remained there until early 1964, "Punch" Jones was killed in World War II and possession of the stone was passed to his father. In February, 1964, the Jones' brought the diamond home and put it in a bank deposit box in the First Valley National Bank in Rich Creek, West Virginia.

When Grover Jones died in 1976 his widow Grace and grandson Robert became owners of the diamond. In 1984, Robert sold the diamond through Sotherby's auction house in New York to an agent representing a lawyer in the Orient for \$74,250 (Macy, 1990). Grace Jones passed away in 1992.



Figure 7. Location of the site of the horseshoe pit along Rich Creek, where the "Punch" Jones diamond was found in 1928, in Peterstown, West Virginia.



Figure 8. Toolshed where diamond was "stored" for fourteen years.

KIMBERLITES IN VIRGINIA

Two known kimberlites in Virginia, a mica peridotite dike in Warren County and the Mount Horeb kimberlite in Rockbridge County, are in the eastern edge of the Appalachian Basin as noted by Southworth and others (1993). Parrish and Lavin (1982) note there is geologic evidence in western Pennsylvania for structure parallel (linear features parallel to the regional structure) Cambrian-Ordovician growth faults. The Virginia kimberlites may be parallel to regional Paleozoic faults although there is no clear evidence of basement faults. Northwest-trending dikes of Jurassic age are present in the Shenandoah Valley and crustal zones of weakness may be created under extensional stress conditions and reactivation of the strike-parallel faults at the intersection of the dikes,

creating cross-strike faults.

The westernmost limit of these dikes appears to be a Late Jurassic mica pyroxenite dike in southern Pendleton County, West Virginia from which biotite produced an argon-argon (Ar-Ar) age of about 147 Ma (Southworth and others, 1993). The undated mica peridotite dike in Warren County is similar to the Pendleton County dike. Garner (1956) notes that peridotite porphyry dikes are located on U.S. Highway 33, about 13.5 miles west of the Virginia-West Virginia State line and consist of 30 percent phenocrysts of augite and olivine in a groundmass of augite, magnetite, and biotite plates.

Mount Horeb - Rockbridge County

A kimberlite occurs in the northeast portion of the Sugarloaf Mountain 7.5-minute quadrangle, near Mount Horeb Church in western Rockbridge County. At the surface, the kimberlite consists of three separate intrusions into an Ordovician age carbonate sequence (Sears and Gilbert, 1976; Figure 9). A geologic map of the area (Spencer, 1968) shows the kimberlite intruding the Beekmantown Dolomite. Sears and Gilbert (1973) note that unaltered primary crystals in the kimberlite include chrome-rich spinel, green clinopyroxene, pyrope garnet, mg-ilmenite, rutile, zircon, and amphibole. Altered material consists of montmorillonite, vermiculite, and chlorite. Xenolithic fragments of sandstone, and fossiliferous limestone are also present. Steidtmann (1948) reported that the peridotite intrusion was in the Conococheague Limestone and that about one-half of the rock consists of phenocrysts (olivine?), completely replaced by serpentine. He also noted that the groundmass contains doubly terminated apatite crystals, which occur as "swarms" around, but not in, the phenocrysts.

According to Sears and Gilbert (1973), the chemistry is sufficient to verify the body as a kimberlite and establish its mantle origin. However, Gilbert (1982, written communication) notes that since spinel is so much more abundant than garnet, that a shallower depth of origin such as 50 to 100 kilometers instead of the normal 150 to 200 kilometers for kimberlite seems likely. The Mount Horeb body may be more aptly a spinel peridotite instead of a garnet peridotite.

A magnetic survey has been conducted up the drainage on the west side of the southernmost intrusion; an anomaly was noted near the road and well into the body to the east. Panning in the drainage has pro-



Figure 9. Exposure of weathered kimberlite off the east side of State Road 807, near Mount Horeb Church, Rockbridge County.

duced ilmenite, pyrope garnet, green diopside, and zircon (A.W. McThenia, 1995, personal communication). Some exploration has been done on sites of two of the intrusions, which are presently owned by two separate landowners. Cominco examined the kimberlite in the early 1980s and Kennecott Corporation was on the property in the late 1980s. No diamonds have reportedly been found at either of these sites.

In the fall of 1995, the Virginia Division of Mineral Resources drilled several auger-holes off the northeast side of State Road 807 (Pullen Road) and on the southwest slope of the kimberlite. The most successful hole was spudded at 1510 feet elevation in weathered kimberlite, to a depth of 34 feet; total depth remained in weathered kimberlite.

Mica Peridotite - Warren County

A mica peridotite dike (600 feet x 150 feet) occurs in Warren County, 4.5 miles west of Front Royal, off the northwest side of State Road 626, approximately 0.35 mile by road northeast of its intersection with State Road 617 (Figure 10).

From a thin section analyses by Young and Bailey (1955), the minerals present were reported to be chlorite, 43 percent; phlogopite, 31 percent; hydrobiotite (?), pseudomorphs after olivine and pyroxene, 13 percent; secondary pyrite, 5 percent; perovskite, partly altered to leucosene, 4 percent; apatite, 2 percent; dolomite, 1 percent; and ilmenite, magnetite, and epidote, less than 1 percent.

The dike, which has been chloritized, was examined by Rader and Biggs (1976). They made two mag-

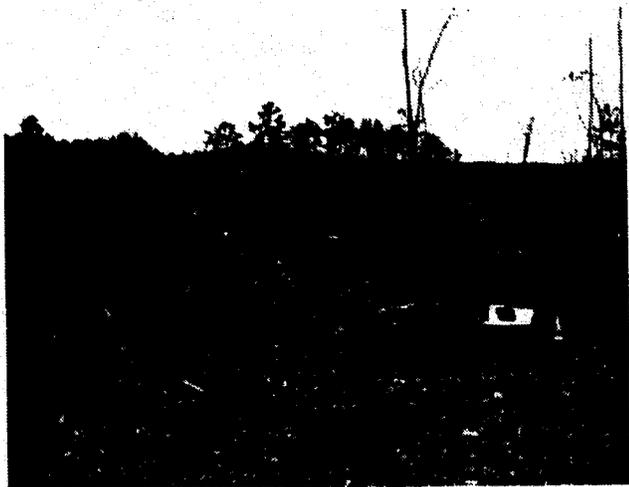


Figure 10. Mica peridotite, located west of Front Royal, Warren County.

netic traverses across the dike, with a GeoMetrics model G-806 portable magnetometer; the traverses show a magnetic zone in the body about six feet thick. Weathered samples were obtained from three pits dug in the easternmost, central and westernmost portions of the dike. X-ray analyses by the Division of Mineral Resources note the following: ankerite, calcite, chlorite, clays, garnet (andradite), magnetite, phlogopite, pyrite, quartz, rutile, serpentine, and talc. Ten soil samples along two traverses were analyzed by atomic absorption and indicated significant peaks for chromium (300-400 ppm) and nickel (300-550 ppm) in both traverses (Rader and Biggs, 1976).

Southworth and others (1993) have described the dike as a mica pyroxenite dike similar to dated late Jurassic dikes in the Appalachians and they indicate the dike to be a kimberlite. At the present time, only scattered pieces of dike rock are present on the site, which extends across properties owned by half a dozen different landowners.

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