

DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Preliminary results of coring
of the Furlong Fault near
Lake Aquetong, New Hope, Pennsylvania

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Open-File Report 86-43

Prepared in cooperation with the Pennsylvania Bureau
of Topographic and Geologic Survey

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature. Any use of trade names is for descriptive purposes only and does not imply endorsement by the USGS.

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INTRODUCTION

Two continuously cored vertical drill holes 716 and 355 feet deep were completed in July, 1985 across the Furlong fault near Lake Aquetong, New Hope, Pennsylvania, in the Lambertville (Pennsylvania - New Jersey) 7 1/2-minute quadrangle. The cores were taken at two sites flanking Lower Mountain Road 1/2 mile south of the intersection with Route 202. Deer Park No. 1 is just east of the road and Deer Park No. 2 is 344 feet northwest of No. 1 (Fig. 3).

The Furlong fault is a major intrabasinal normal fault, down on the east-southeast side. The footwall exposes the Paleozoic carbonate rocks and floor of the Newark basin at Buckingham Mountain (Fig. 2). The hanging wall consists of red mudstones of the Upper Triassic Brunswick Formation intruded by major sills and dikes of Jurassic diabase.

Locally, barite and copper mineralization occurs along the Furlong fault and prospects are present in the immediate vicinity of the drill site. Barite, copper and granophyric intrusions are also known along the Flemington fault, a northeast continuation of the Furlong fault. The last movement on the Furlong-Flemington fault system post-dated intrusion of granophyre and diabase; however, earlier pre-diabase displacements are possible (Burton and Ratcliffe, unpublished data). Cumulative vertical displacement on the Furlong-Flemington fault system may be as great as two kilometers, as it affects rocks as young as the Lower Jurassic Orange Mountain Basalt, and as old as Upper Triassic Stockton Formation.

The drill sites were chosen to sample rocks of the hanging wall and footwall, to recover samples of the faults to determine their attitude and movement history, and to understand the relationship of faulting to mineralization.

The core sites are located about 1,000 feet northeast of two test water wells installed for the Bucks County Planning Commission by Roy Weston Environmental Scientists and Engineers in 1968 (Bucks County test wells Nos. 3 and 5). (Appendix C).

The information contained in this report is preliminary. Owing to the extensive cataclasis and subsequent mineralization within the fault zone, there is considerable uncertainty in the identification of the protoliths, especially of the feldspathic dolomitic rock above the diabase in both cores. Final evaluation will be based on petrographic, x-ray diffraction and chemical analysis of the samples now in progress.

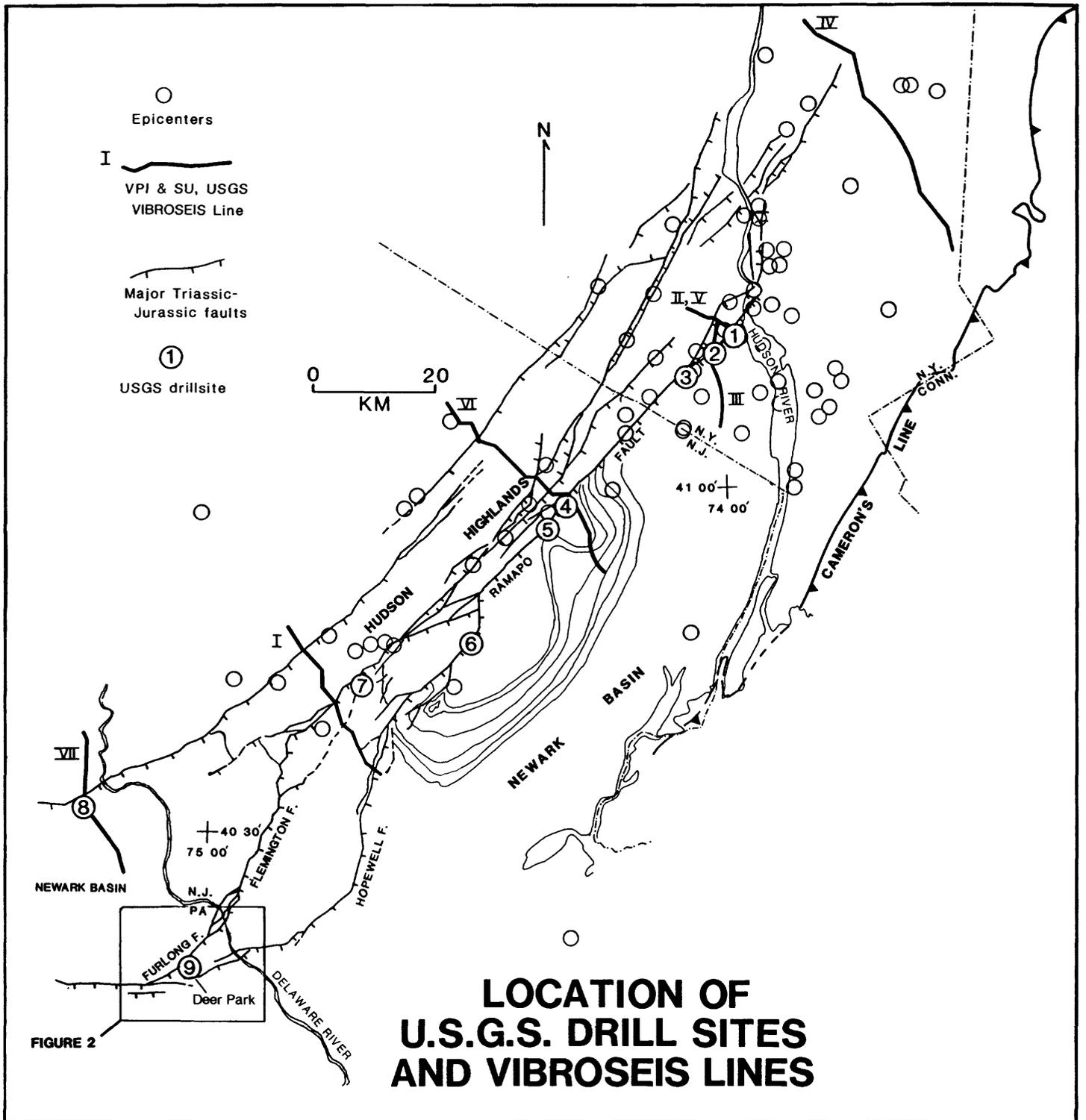


Figure 1. Regional geologic map showing location of major border faults of the Newark basin, the Furlong Fault and location of the drill site near New Hope (site 9), in relation to other USGS drill sites, seismic lines, and earthquake epicenters along the margin of the Newark basin.

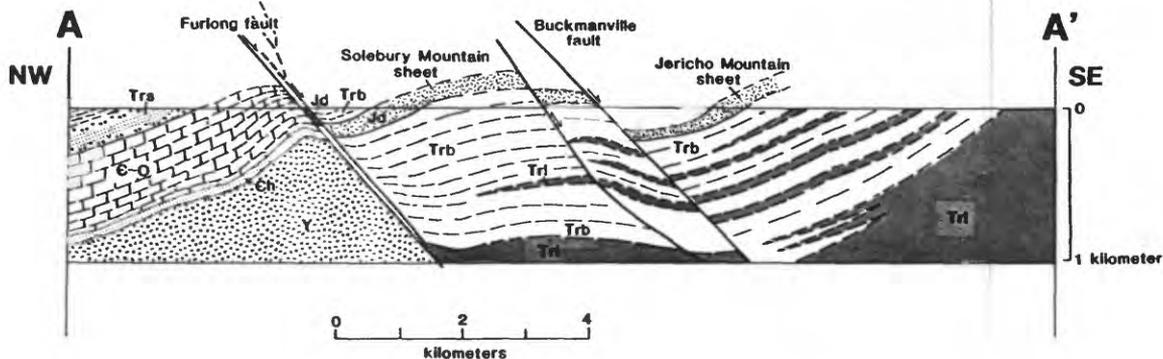
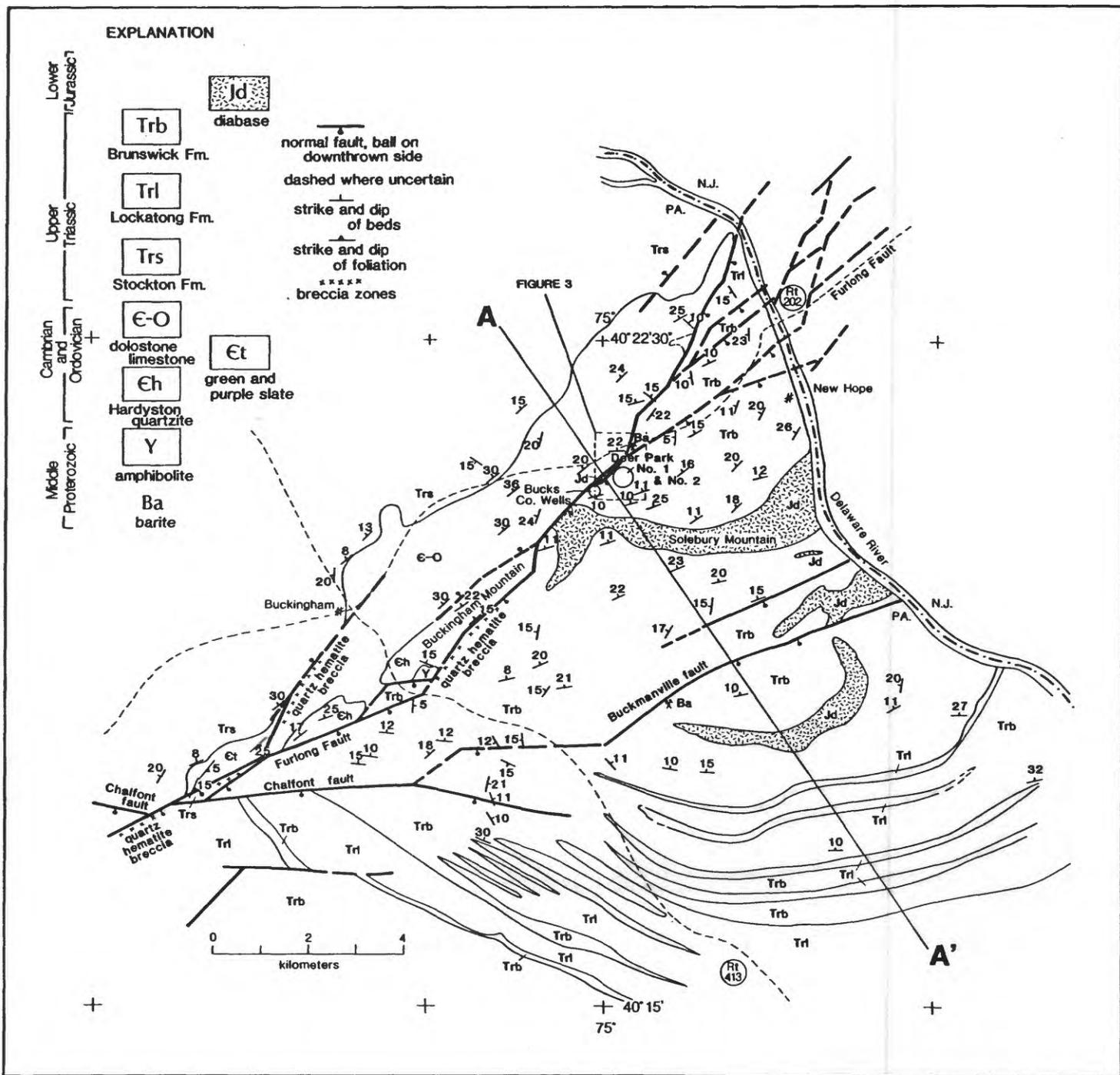


Figure 2. Geologic map and cross section of the New Hope area showing location of drill site and major faults. Map modified from Willard and others (1959).

LOCATION AND DESCRIPTION OF DRILL HOLES

Deer Park No. 1

Core hole No. 1 was started in Triassic mudstones of the hanging wall block of the Furlong-Flemington fault east of Lower Mountain Road on the Stoop property. Collar elevation was approximately 208 feet. Four-inch casing was set to 60 feet and HQ (2 3/8 inch diameter) core taken to 200 feet and NQ (1 7/8 inch diameter) to 716 feet. Duplicate measurements of verticality using a spring loaded compass and inclinometer (Pajari instrument) gave a 5° inclination toward N. 38° E at 596 feet, indicating that the hole was substantially vertical. Recovery throughout was excellent with only minimal loss in softer zones. In Deer Park Hole No. 1, 12.1 ft. of core was not recovered out of 716 feet of core drilled, including about 6 1/2 feet during the changeover from HQ to NQ rod at 200 ft., plus isolated short segments (1-3 ft.) elsewhere, for a recovery percentage of 98%.

Deer Park No. 2

Deer Park No. 2 was sited 344 feet northwest of No. 1 at the west side of Lower Mountain Road near the site of a house excavation that exposed the cataclasite of the fault zone. Collar elevation was approximately 210 feet. Four-inch casing was set to 24 feet and NQ core (1 7/8 inch diameter) taken from 24 to 355 feet. Measurement of verticality using a Pajari instrument yielded values of 1° inclination to N. 40° E at 345 feet, indicating that the hole was vertical. Some loss of section occurred in the upper part of Deer Park No. 2 (above 100 feet), where isolated short segments of core (1-2 ft.) were lost for a total of 16.5 feet of no recovery out of 355 feet (95% recovery).

Excavation for a house foundation near Deer Park No. 2 exposed Triassic mudstone and cataclasite of the fault zone. The trenched area was mapped at 1 in to 10 ft and is shown in Figure 4.

Bucks County test wells

In 1968 two test wells for hydrologic studies were installed across the Furlong fault for the Bucks County Planning commission by R. F. Weston Environmental Scientists and Engineers. Bucks County test wells Nos. 3 and 5 are located about 1,000 feet southwest of Deer Park 1 and 2 as shown on Figures 2 and 3. Test well No. 5 is located 200 feet northwest of No. 3. No. 3 reached a depth of 518 feet in the Brunswick Formation, whereas No. 5 crossed the Furlong fault of a depth of 334 feet and extended to a total depth of 615 feet in dolostone and quartzite of the footwall. (Appendix C).

RESULTS OF CORING AND MINERALOGY OF FAULT ZONE ROCKS

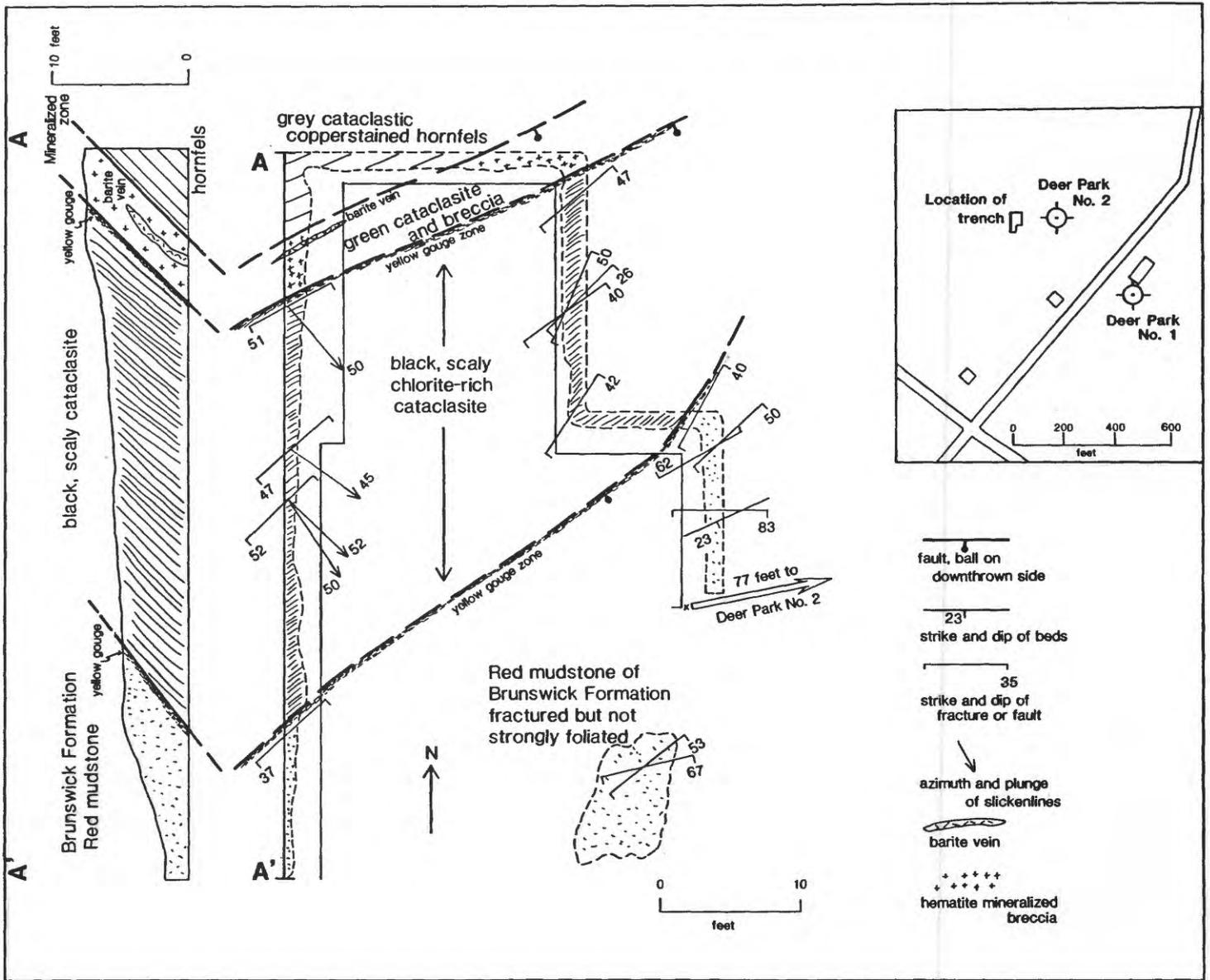
In both Deer Park No. 1 and Deer Park No. 2 there was perfect recovery of the lower two major faults and partial recovery of the upper one (fig. 5). Deer Park No. 1 penetrated 458 feet of red and deep reddish brown mudstone of the Brunswick Formation (Appendix A). Bedding dips as much as 20° to southeast. Root casts and calcitic caliche zones are abundant. Between 458 and 490 feet a complexly faulted, brecciated, and mineralized zone containing clasts of light to dark gray or grayish green dolomitic, low-temperature-albite-calcite rock, possibly altered dolostone, was encountered. An apparent fault contact at 458' separates these rocks from mudstones above. The actual contact was not recovered or has been obscured by later mineralization. Cataclastic structures are abundant, expressed by chlorite-rich, hematite-coated and calcite-filled fractures that dip 45° to 55° southeast. Mineralization included introduction of pyrite, low albite, calcite, and dolomite into the rock.

At 490 feet a sharp fault contact with underlying altered coarse-grained diabase is preserved. The actual fault consists of a 5 mm- wide zone of green chloritic gouge, bordered by 1-2 cm wide zones of hematization above and below. The diabase of the footwall is not chilled and the dolostone (?) clasts of the hanging wall are apparently not contact metamorphosed, indicating that the original intrusive contact of the diabase has been removed by faulting.

From 490 feet to 712 feet altered coarse-grained diabase and granophyre were recovered. Veins of calcite, dolomite, low-albite, hematite and pyrite crosscut the diabase, which is locally cataclastic. Veins are brecciated by faults younger than the mineralization. Little primary mineralogy is preserved in the diabase, although igneous textures are readily apparent.

At 712 feet a sharp fault contact between diabase and dolostone is preserved that dips 50° to the southeast, and consists of a zone several centimeters thick of chloritic and hematitic breccia. Four feet of grey dolostone and white quartzite was recovered beneath the fault. Mineralization appears to stop abruptly beneath the fault.

In Deer Park No. 2 (Appendix B) red and dark brown mudstone and cataclastic mudstone was recovered to a depth of 94 feet. From 94 feet to about 138 feet a mixture of white dolomite-albite rock and pyrite-rich mineralized material was recovered. The white rock may be highly mineralized fault breccia, although this is difficult to determine from present data. Beneath 138 feet a zone of dark green fine-grained diabase, probably representing a chilled margin, is present. From 164 to 171 feet a fault-bounded sliver of the white altered rock occurs, underlain by more green rock. Below 176 feet down to a depth of 311 feet coarse-grained but highly altered diabase is present. The upper contact of the coarse-grained diabase with chilled diabase also appears to be faulted, with subsequent mineralization. This diabase is largely replaced by calcite, dolomite, albite, and quartz, and veins of these minerals obscure the original texture. The contact at 311 feet with



**SKETCH MAP OF EXPOSURE OF FURLONG FAULT ZONE
NEAR LAKE AQUETONG AND DEER PARK NO. 2**

Figure 4. Detailed map of trench and vertical profile of cataclasite in the Furlong fault zone near Deer Park No. 2.

underlying dolostone was perfectly recovered and is a sharp fault contact identical in nature to the lower fault in Deer Park No. 1 at 712'. Cataclastic structures are strongly developed and dip 45 to 55° to the southeast. Dolostone under the fault is less mineralized than rocks above the fault and a late, post-mineralization age for the fault seems likely, as seen in the lower fault of Deer Park No. 1.

Study of x-ray diffraction patterns from the diabase, altered fault breccia(?), and the red mudstone of both cores reveals the ubiquitous presence of low-temperature albite and the absence of clay minerals except in some of the younger well-defined gouge zones. Veins within all rocks consist of various proportions of dolomite, calcite, low albite, chlorite, pyrite, hematite and quartz. Specular hematite and pyrite are abundant as minerals disseminated through the breccia zones.

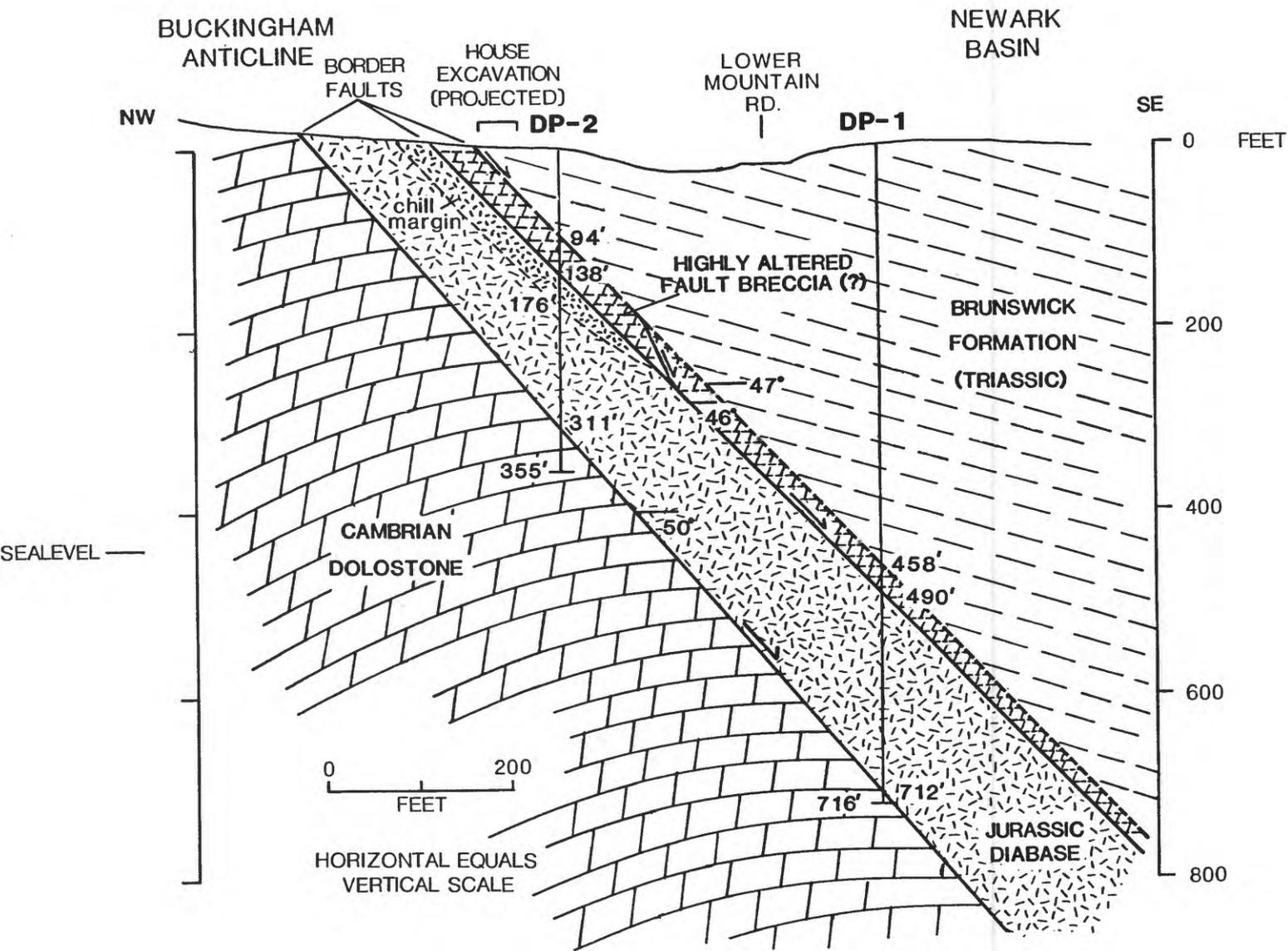
Exposures of the fault zone in the excavation (Figure 4) show southeast dipping zones of gouge and black cataclasite. The contact with the grey mineralized rock was found in the northwest corner of the excavation.

Taken together the data indicate that the Furlong fault is a complex zone of subparallel faults that dip 47° and 50° to the southeast.

INTERPRETATION

Preliminary interpretation of the data indicate that coarse-grained diabase is in fault contact with a mineralized fault breccia above and dolostone below; low-temperature mineralization post-dated some faulting, but later faults responsible for the present floor of the diabase body and part of its roof post-dated this mineralization. The data are consistent with intrusion of diabase into the fault zone following major down-faulting, although this interpretation is not confirmed by clearly preserved high temperature contact effects on the bordering rocks. Renewed fault movement then occurred after intrusion and mineralization.

Bucks County test wells 3 and 5 provide some control on the strike and dip of the Furlong fault. Well 3 did not penetrate the fault and stayed within mudstone to a depth of 518 feet. Test well 5, however, penetrated the fault at 310 to 346 feet based on the logs in Appendix C. No diabase apparently was present although the greenish serpentine-like material could have been chloritic cataclasite derived from diabase. These data indicate a dip in excess of 45° for the Furlong fault.



**CROSS SECTION THROUGH DEER PARK HOLES 1 & 2
SHOWING RESULTS OF CORE DRILLING**

Figure 5. Cross section through Deer Park Nos. 1 and 2 showing major faults and rock units.

GEOPHYSICAL DATA

Aeromagnetic maps of the Bucks County area (Bromery and others, 1959a, b) (Figure 6) reveal a northeast-trending positive anomaly on the footwall block west of the Furlong fault and an arcuate positive anomaly associated with diabase on Solebury Mountain. In the vicinity of the drill site an elliptical positive anomaly with a closure of 1250 gammas is present, centered on the actual fault trace. The drill sites are situated on the east flank of this anomaly.

A ground magnetic survey, utilizing a truck borne magnetometer, was conducted in July by Mark Gettings and Kevin Bond of the USGS. The route of this traverse is shown in Figure 6. Magnetic susceptibility of the cores of Nos. 1 and 2 were determined at one-foot intervals. Magnetization is pronounced in the diabase in both cores but is highly variable depending upon the degree of alteration of the primary ilmenite-magnetite in the diabase.

Preliminary modeling by Gettings indicates that a highly magnetic source other than the diabase must underlie the Furlong fault. This magnetic rock could be highly magnetic basement rock or magnetite-rich skarn or a combination of both.

PETROGRAPHIC AND X-RAY MINERALOGY OF CORE SAMPLES

Approximately 55 thin sections and a equivalent number of x-ray diffraction powder patterns from the cores have been examined thus far. These results show that alteration of all rocks, but especially those within the fault zones, has been extensive.

The latest episode of mineralization recorded in the cores involving calcite-chlorite and quartz mineralization pervades all fault breccias. Grains of untwinned (nondeformed) calcite are common in veins. An earlier episode, consisting of albitization with associated chlorite-calcite-dolomite-pyrite mineralization, is responsible for replacement of carbonate rocks, red mudstone, diabase, and chilled diabase. Breccia zones and cataclasites derived from all the protoliths above have themselves been replaced by low temperature albite, dolomite, calcite, and chlorite in the same alteration event. Locally, near the chill diabase in Deer Park No. 2, 0.2 mm long flakes of white mica, phlogopite, and biotite are found within the altered breccia suggesting higher temperature alteration closest to the diabase.

The diabase in both cores is largely coarse-grained granophyric diabase consisting of large 3 mm non-zoned well-twinned plagioclase (An_{38-40}), and replaced monoclinic pyroxene. No primary pyroxene is preserved in any specimen, although euhedral, calcite-chlorite-hematite pseudomorphs after original, herringbone-twinned monocline pyroxene are abundant. Plagioclase is surrounded by micropegmatitic and granophyric quartz in plagioclase and microcline. Locally the coarse granophyre

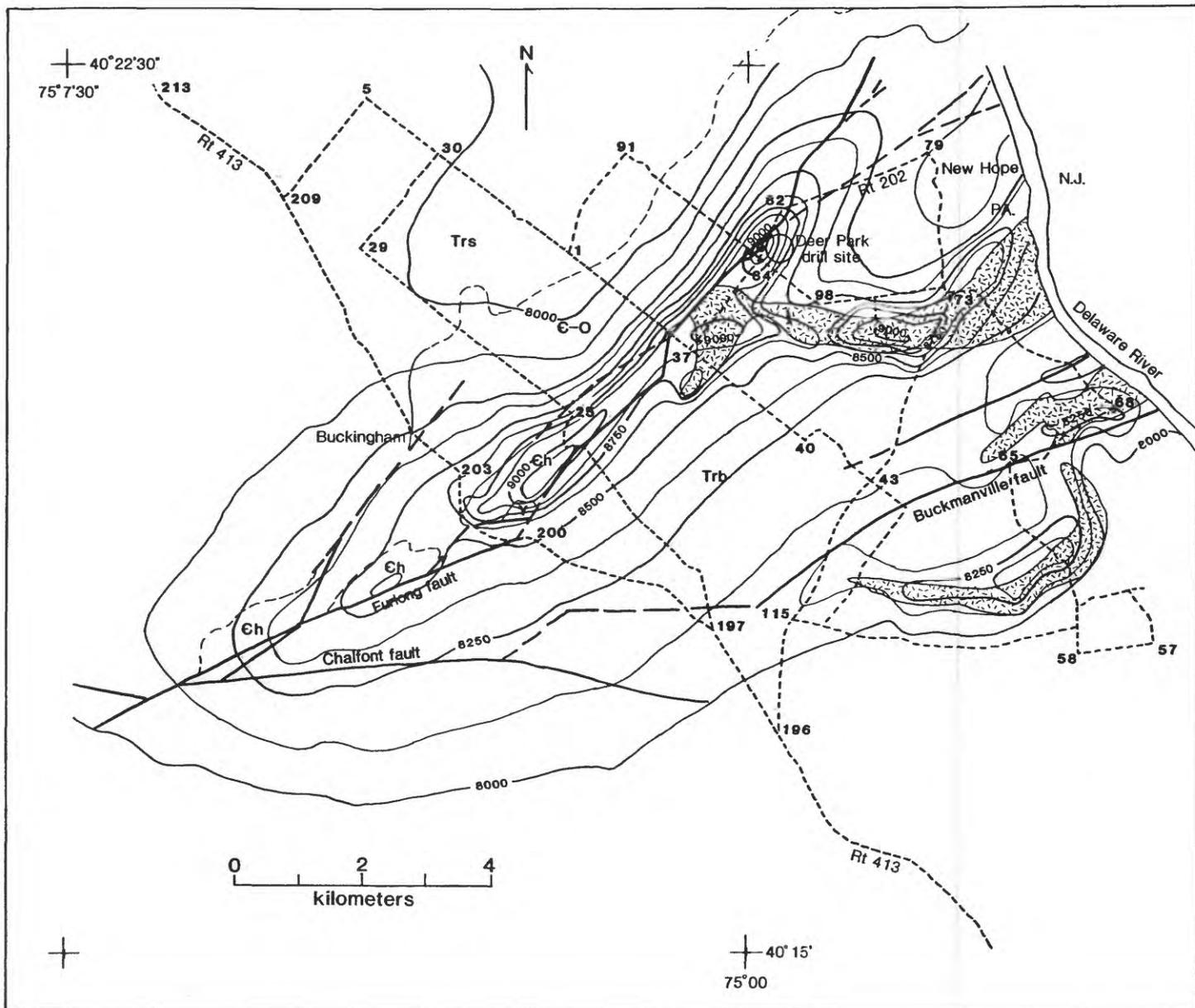


Figure 6. Aeromagnetic map of the Buckingham area, showing route followed in truck magnetometer survey. Bold numbers refer to documentation points along traverses (dashed lines). Contours in nanoteslas. From Bromery and others (1959a).

contains a granular, quartz-rich, plagioclase-microcline residuum. The original pyroxene to plagioclase ratios vary from 50:50 in some chilled varieties to 5:95 in the coarse-grained granophyre and in irregular veinlets of fine-grained granophyre. Seventeen samples of altered rocks, diabase and vein assemblages have been submitted for whole rock and semiquantitative spectrographic analyses. These results will not be available until summer 1986.

GEOFYSICAL LOGGING OF DEER PARK NO. 1

Geophysical logs of the Deer Park No. 1 well were run by Daniel Moos and Roger N. Anderson of the Borehole Research Group, Lamont-Doherty Geological Observatory during the Fall of 1985. The logs included caliper, natural gamma, delta-t (sonic velocity), and single-point resistance (Appendix D). A borehole televiewer (BHTV) log was also run to determine the orientations of planar features such as fractures and faults. The caliper log shows the change in hole size at 206 feet from HQ to NQ, and reveals that the well was in gauge throughout. The fault at 490 feet was not washed out by the drilling process (Appendix D, first column).

The upper fault at 490 feet which juxtaposes the mudstones of the hanging wall and the diabase of the foot wall is clearly indicated by a sharp drop in natural radioactivity across the contact (Appendix D, second column). This is presumably due to a higher potassium content in the mudstones. Sonic compressional velocity also drops at the fault contact, from about 5.5 km/s in the mudstone to less than 4.5 km/s in the diabase (Appendix D, third column). The anomalously low velocity in the diabase is due to its pervasive alteration. Otherwise, sonic velocity increases steadily with depth in both the diabase and the mudstone. This is probably the result of decreasing porosity with depth due to the closure of microcracks in response to increasing overburden pressure. Local low velocity zones may be caused by natural fractures, small fault zones, or groundwater channels. Stepwise changes in natural radioactivity and sonic velocity in the mudstones may be related to variations in grain size, mineralogy, alteration or brecciation. Although the resistivity log (Appendix D, column 4) is uncalibrated, small-scale variations in this log also reflect local changes in the properties of the in situ rock.

The lower fault at 712 feet was not sampled by these logs, as the drill hole only penetrated four feet below the fault, and the sensors are several feet above the bottom of each instrument package.

GEOLOGIC SYNTHESIS

Water well data from Bucks County test wells 3 and 5 and from the two core holes indicate that the Furlong fault strikes northeast and dips about 50° southeast. Mineralization involving low-temperature albite, dolomite, calcite, chlorite, quartz, pyrite, and hematite was extensive within the fault zone and affects rocks of the footwall and hanging wall. Late (post-mineralization) faulting downdropped the mineralized dolostone, the diabase, and the Brunswick Formation,

suggesting a complex history of faulting. One plausible interpretation of the data is down-faulting of Brunswick Formation against dolostone before intrusion of granophryic diabase into the fault zone, followed by widespread low temperature mineralization of the breccia zone, and late faulting to dropdown the mineralized material as a sliver, placing it in contact with relatively unaffected dolostone of the footwall.

IMPLICATIONS FOR SEISMICITY

No data found in this investigation require modern reactivation of the Furlong fault. Examination of the gouge material in the youngest fault zones reveal slickenlines and microcataclastic structures consistent with normal faulting. The lack of compressional structures or horizontal slickenlines suggests that the fault has not moved under the modern compressional stress field. Nonetheless, the Furlong fault can be shown to be a major north-to northeast-striking fault zone that dips 45° to the southeast and east which is therefore suitably oriented for reactivation in a strike slip or thrust mode in the modern compressional stress field that places the principal horizontal compressive stress in the northeast quadrant, at N. 55° E. $\pm 10^{\circ}$ (Zoback, Anderson, and Moos, 1985).

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APPENDIX A

Description of lithologies and contacts in core, Deer Park Hole No. 1

	<u>Thickness</u>	<u>Depth</u>
Massive red mudstone of Brunswick Fm. (Triassic), with minor thin beds (1-3 ft thick) of purple laminated siltstone and green and black shale. Abundant clacified root casts, burrows, and caliche horizons.	458'	0-458'
Highly altered and mineralized (hematite-dolomite-pyrite-chlorite-calcite) fault-zone breccia, containing blocks of carbonate, mudstone, and possible diabase fragments.	32.7'	458-490.7'
Major fault contact between Brunswick Fm. (hanging wall) and diabase (footwall), dipping 47° SE. Consists of sharply defined zone of green chloritic gouge 0.2 in thick with 1-2 in thick zones of hematitic alteration above and below.		490.7'
Medium to coarse-grained diabase, (Jurassic) with mafic mineral (pyroxene) largely altered to chlorite and extensively sericitized plagioclase.	216.3'	490.7-707'
Fine-grained white cataclastic diabase, above major fault.	6.3'	707-712.3'
Major fault contact, dipping 50° SE, between diabase (hanging wall) and Paleozoic dolostone (footwall), characterized by a zone of soft black gouge 1 in thick overlain by a 5 in thick zone of dark red hematized fault breccia.		712.3'
White dolostone, fine-grained and cataclastic, with chloritic shear surfaces related to faulting.	2.7'	712.3-715'
White vitreous quartzite, in fault contact (60° SE) with dolostone above.	1'	715-716'
End of hole		716'

APPENDIX B

Description of lithologies and contacts in core, Deer Park Hole No. 2

	<u>Thickness</u>	<u>Depth</u>
Red massive mudstone of the Brunswick Fm., with minor beds (1-2 ft thick) of laminated purple siltstone and green shale, and thin zones (0.5-1 ft thick) of alteration and mineralization.	94'	0-94'
Contact between mineralized but recognizable red mudstone and highly altered, dark gray material, interpreted as a fault (not recovered).		94'
Highly altered albite-dolomite-quartz-chlorite rock, dark grey (94-105') to white (105-138') in color, shot through with a dense network of veins containing calcite, dolomite, hematite, and pyrite. Interpreted to be totally altered fault breccia of diabase, mudstone, and possibly dolostone fragments.	44'	94-138.5'
Silicified fault contact (46° SE) between albite-quartz-dolomite material above and dark green, fine-grained diabase below.		138.5'
Dark green aphanitic diabase (interpreted as chilled margin), cut by veins of quartz, dolomite, calcite, and pyrite.	25.5'	138.5-164'
Light-colored albite-dolomite-quartz rock, identical to some of the material described above. Considered to be altered diabase or felsic igneous material intrusive into diabase.	7'	164-171'
Fault contact (60° SE), mineralized by quartz and hematite, between light-colored rock (above) and aphanitic diabase (below).		171'
Dark green, aphanitic diabase.	5'	171-176'
Sheared and brecciated contact (40° SE, mineralized) between aphanitic (above) and medium-grained diabase (below).		176'

APPENDIX B (CONT.)

	<u>Thickness</u>	<u>Depth</u>
Medium-grained diabase, locally granophyric, altered and cut by veins of quartz, calcite, dolomite, and pyrite.	135'	176-311'
Major fault, dipping 50° SE, between Jurassic diabase (hanging wall) and Paleozoic dolostone (footwall), consisting of 1-2 in of soft green chloritic gouge bounded by 2-3 in of harder green chloritic cataclasite.		311'
Light to dark gray dolostone (Cambrian), partly cataclastic, containing beds (2-5 in thick) and nodules of blue chert, and locally a chloritic (mylonitic?) foliation.	44'	311-355'
End of hole.		355'

APPENDIX C
(from Weston 1969)

Test Well 3

West of Aquetong Road, North of Spring Road
Solebury Township, Bucks County, Penn.

<u>Description</u>	<u>Thickness (Feet)</u>	<u>Depth (Feet)</u>
Brown clay, silt, fine-grained sand, with fragments of shale and siltstone	2	2
Shale, red-brown, silty	53	55
Shale, red-brown, silty, slightly calcareous along openings	45	100
Shale, red-brown, silty, interbedded with gray, silty shale	8	108
Shale, red-brown, silty	12	120
Shale, red-brown, silty, with small amount of calcite deposition along openings	14	134
Shale, red-brown, silty, interbedded with fine-grained grayish shale	7	141
Shale, red-brown, silty to sandy with slight amounts of calcite deposition along openings	13	154
Shale, red-brown, silty with moderate calcite deposition along openings	49	203
Shale, red-brown, silty with slight amounts of calcite deposition along openings	15	218
Shale, red-brown, interbedded with gray shale, silty to sandy	5	223
Shale, gray, silty	10	233
Shale, gray, silty to sandy, interbedded with red-brown shale with slight calcite deposition along openings	7	240

APPENDIX C (CONT.)

<u>Description</u>	<u>Thickness (Feet)</u>	<u>Depth (Feet)</u>
Shale, gray, silty to sandy with slight calcareous deposition along openings	50	290
Shale, red-brown, silty	33	323
Interbedded red-brown, gray silty to sandy shale with slight amount of calcite deposition along openings	30	353
Shale, brown to red-brown, silty, slight amounts of calcite	45	398
Interbedded, red-brown to gray, silty to sandy shale	7	405
Shale, brown to red-brown, silty to sandy, very slightly calcareous	64	469
Shale, gray, silty	5	474
Interbedded red-brown, gray, silty shale	9	483
Shale, brown to red-brown, silty, very slight amounts of calcite deposition along openings	32	515
Interbedded, brown to red-brown, and gray, silty, shale	3	518

APPENDIX C (CONT.)

Well Log

Test Well No. 5
Solebury Township, Bucks County, Pennsylvania

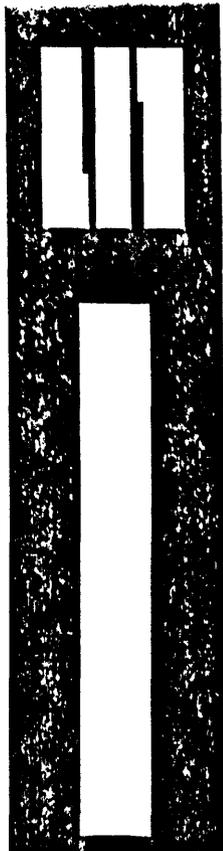
<u>Description</u>	<u>Thickness (Feet)</u>	<u>Depth (Feet)</u>
Red Shale	25	25
Dark gray shale with pyrite association	5	30
Dark gray shale with red shale interbedding with calcite deposition along opening. Pyrite association	30	60
Red shale with gray shale interbedding. Pyrite association	9	69
Red shale with some gray shale interbedding	10	79
Gray shale with some red shale interbedding, and with pyrite association	5	84
Red shale with some gray shale interbedding, and with pyrite association	5	89
Red shale with gray shale interbedding and with pyrite association and calcite deposition along openings	5	94
Gray shale with red shale interbedding with pyrite association and calcite deposition along openings	5	99
Red and gray interbedded shale with pyrite association and calcite deposition along openings	20	119
Gray and red interbedded shale with pyrite association and calcite deposition along openings	5	124
Gray shale interbedded with some red shale and traces of calcite deposition along openings	10	134

APPENDIX C (CONT.)

<u>Description</u>	<u>Thickness (Feet)</u>	<u>Depth (Feet)</u>
Red and greenish-gray to gray interbedded shale with calcite deposition along openings. Pyrite association		907
Greenish-gray and red interbedded shale with calcite deposition along openings	3	310
Greenish serpentine like material with traces of red shale and calcite deposition along openings. Also, gray to white dolomite	24	334
Gray to white dolomite with green serpentine like material with traces of red shale	12	346
Gray to white dolomite with some iron staining and black carbonaceous material	10	356
White dolomite with iron staining and some black carbonaceous material	10	366
White to greenish-gray dolomite with yellow staining	5	371
White dolomite with red and yellow staining and black carbonaceous material	25	396
Gray to white dolomite with red and yellow staining. Black carbonaceous material	10	406
White to gray dolomite with red and yellow staining. Black carbonaceous material	5	411
Gray to white dolomite with red and yellow staining and black carbonaceous material with some pyrite association	35	446
Gray to white dolomite limestone with white dolomite and some pyrite association	40	486
White quartz with dark gray to white dolomitic limestone		541

APPENDIX C (CONT.)

<u>Description</u>	<u>Thickness (Feet)</u>	<u>Depth (Feet)</u>
Dark gray to white dolomitic limestone with quartz, brown staining, and black carbonaceous material	30	571
White quartz with brown-red staining, gray to white dolomitic limestone. Black carbonaceous material with pyrite association.	44	615

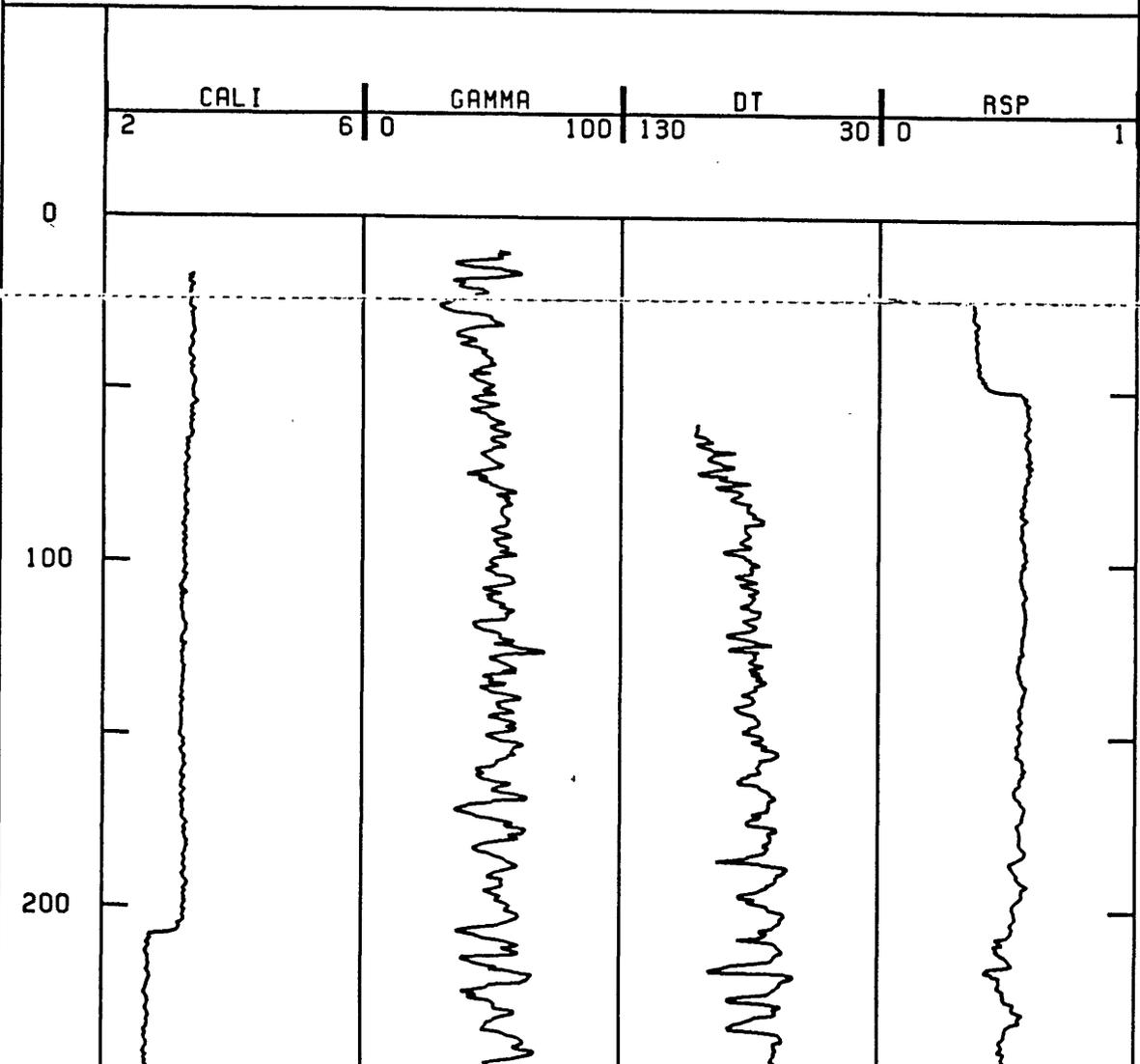


WELL NO. ** DPK-1
 OPERATOR USGS RESTON
 WELL NAME DEER PARK #1
 FIELD RESEARCH
 COUNTY BUCKS
 STATE PENNSYLVANIA
 LOCATION NEW HOPE
 COUNTRY USA
 PROJECT
 ELEVATION 0
 COMMENTS LOGGED 11/6/85 BY MOGS
 ANDERSON SCHOLZ
 WITNESSED BY BILL BURTON

DEER PARK # 1
 LOGGED 11/6/85
 LDGO BOREHOLE RESEARCH GROUP

WELL NO. DPK-1

DATE PLOTTED: 12-NOV-85 17:12



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