THE CHARACTERISTICS AND ORIGIN OF SOILS ASSOCIATED WITH THE LINDBERGH KIDNAPPING CASE

Liz Pagel 11/1/04

On March 1, 1932, the 20-month-old Charles A. Lindbergh, Jr., was taken from the family home near Hopewell, New Jersey. A ransom note demanding $50,000 was found lying atop the radiator grate in the nursery. Outside, in the mud, a trail of footprints led off in a southeasterly direction toward an old farm road, Featherbed Lane. Some 60 to 70 feet from the house, two sections of a homemade ladder were found, with a third section lying about 12 feet further. A 3/4" Bucks chisel was found nearby.

In May, 1932, Trooper Frank A. Kelly transported the ladder to Washington, DC, for examination by Dr. William T. Souder, Chief of the Identification Laboratory, Bureau of Standards. At the same time, six specimens of dried mud found on the ladder, an unidentified substance from the groove in the chisel handle and a soil sample taken from the Lindbergh yard were analyzed by the Department of Agriculture, Bureau of Chemistry and Soils. The results of this analysis were compiled in a memorandum written by W. H. Fry, soil petrographer, to Dr. H. G. Knight, Chief of Bureau, dated May 24, 1932.

The following excerpts from the USDA memorandum were used as the basic criteria for this research:

Sample No. 1: "The sample from the upper end of the right upright, No. 1, consists mainly of quartz, clay material and a trace of calcite. The quartz is present as much larger particles than any found in the other samples and has a clean, clear appearance. The clay material has an aggregated structure and therein differs markedly from all of the other samples. The calcite is present only as minute traces. Unquestionably this end of this upright has been in contact with sandy soil, presumably a soil of the general character of a sandy loam."

Sample No. 2: "The sample from the upper end of the left upright of the ladder, No. 2, contains the same minerals as the soil sample, No. 8, and epidote, hornblende, tourmaline, muscovite, and a trace of calcite in addition. Quartz is present in much larger quantity than in No. 8. The muscovite is not plentiful, but is distinct. The epidote occurs only as fare particles. The calcite is present only as the merest traces. The tourmaline also occurs as traces. The clay materials are apparently identical with the same material in the yard sample, No. 8. I am forced to conclude that this end of this upright had been in contact with two soils, that of the yard and some other of a more quartzose nature containing fairly fresh muscovite."

Sample No. 8: "The sampe [sic] of soil No. 8 consists essentially of plagioclase feldspars, decomposed biotite, clay materials, quartz, and manganese concretions (tested by H202). The plagioclase sometimes shows twinning structures, sometimes not. The refractive index indicates that this residual feldspar tends toward the sodic rather than the calcic end of the series. The biotite is decomposed. It gives vague interference figures with sensibly zero or very small axial angle and is optically negative. It shows, of course, micaceous structure. The clay materials are platy rather than heterogeneously aggregated. Their double refraction is high for this type of material. Wavy extinction is fairly common. Particles occasionally give a very vague interference figure with small axial angle and negative optical character. Such particles presumably were originally a mica, probably biotite. Quartz is present in exceptionally small quantity." Sample No. 8 was collected from the Lindbergh yard beneath the nursery window.

Samples No. 3, No. 4, No. 5, No. 6, No. 7 & No. 9 were not specifically included in this soil analysis research. Samples No. 3, No. 4, No. 5 & No. 6 were collected from the lower ends of the middle and bottom sections of the ladder. They were not described in detail, but were noted to be identical to Sample No. 8. Sample No. 9, a rock, was not described in detail but noted to be diabasic in character and typical of the Sample No. 8 soil, which was collected from the yard. Sample No. 7, the material from the chisel, was described as an unidentifiable 'blackish, gummy material' containing calcium carbonate crystals similar to those found in lime.

THE SOIL

Soil is a porous mixture of inorganic particles and decaying organic matter, containing air, water and various macro- and micro-organisms. Ordinarily, numerous properties and characteristics are included in the analysis of a soil sample. The USDA memorandum includes only three: texture, structure and mineralogy.

The inorganic materials are the accumulated residue of massive layers of rock. Subjected to the forces of weathering, the parent rock breaks down into smaller rocks which break down into even smaller rocks and, eventually, into the minerals of which the rock was composed. With the exception of bog and marsh soils, organic matter makes up only a small percentage of the solum and is primarily found in the uppermost layers, or horizons.

Minerals found within the soil fall into one of three classifications based upon their size. Sand particles are irregular in shape with sharp or rounded edges. While they vary in size (up to 2 mm), all are visible with the naked eye. Silt particles are also irregular in shape, with rounded edges. Individual silt particles cannot be seen without magnification. As the weathering process continues, less resistant elements are leached from the minerals. They may be replaced by different elements, especially silica and magnesium, which have been leached from other minerals. It is in this way that clay particles are formed. Individual clay particles can only be seen under high magnification.

Soil texture classifications are determined by the proportions of these three size groups. At the extremes are sand (containing not less than 85% sand particles) and clay (containing not less than 50% clay particles). Between these two extremes are: loamy sand, sandy loam, loam (or mixed loam), silty loam, silty clay loam and clay loam. A soil may be further classified by the size of the sand particles (e.g. fine sandy loam) or by a significant content of rock fragments (e.g. gravelly loam).

Soil structure refers to the arrangement of soil particles into distinctive groups or clusters. The mechanics of soil structure are complex, but parent material, physical and chemical soil-forming processes, integration of organic matter and climatic conditions are primary factors.

In platy soils, as found in Samples No. 2 & No. 8, particles aggregate into thin, horizontally layered plates, leaflets or lenses. These structural forms are created when flat, smooth particles (such as clays or micaceous soils) are deposited by, or into, water and settle gradually.

The granular form, as found in Sample No. 1, consists of irregularly rounded clusters of organic and inorganic material. A mixture of clay, silt & sand in the granular form has been referred to as heterogenously aggregated.

THE MINERALS

A mineral, by definition, is a naturally occuring, inorganic, homogenous solid with a definite chemical composition and an ordered atomic arrangement. That said, let us simplify matters by saying that a mineral is composed of one or more elements, a rock is composed of two or more minerals, and a formation is composed of two or more kinds of rocks.

With the exception of calcite, a carbonate, the minerals listed in the description of Samples No. 1 & No. 2 are all silicates. Quartz, muscovite and calcite are extremely common. Hornblende, epidote and tourmaline are formed under more specific geological conditions. The combination of quartz, hornblende, muscovite, epidote, tourmaline and calcite may have originated in an area where one mafic metamorphic rock has undergone at least two separate metamorphisms, one medium- to high-grade and the other low- to medium-grade. Further, in the northeastern United States, muscovite is a 'marker' mineral for Devonian era metamorphism and epidote is a 'marker' mineral for later Devonian era retrogressive metamorphism.

ANALYSIS OF THE SOIL AND MINERALOGICAL DATA

The attached chart shows the analysis of soil samples collected at, or in close proximity to, Lindbergh case related sites. Soil samples were collected and analyzed from multiple locations in proximity to each of these sites. Analysis of the soil sample taken from the closest location to each site is included in this report. Additional soil samples corresponded to the soil sample shown for each site, except for soil sample JC2 which consisted of non-indigenous 'fill'.

The silt & sand mineralogy of the case-related soil samples include minerals not found in the USDA memorandum. Modern specimen preparation and identification methods, combined with larger quantities of soil available for analysis, account for the increased number of minerals identified. For example, larger quantities available allow for the performance of soil separation tests, which also yield clean silt & sand particles for examination.

To facilitate comparison, the minerals found in the questioned soil are shown in blue ink when listed in the silt & sand mineralogy of the soil samples. Minerals are shown in descending order of abundance.

Sourland Mountain and Mount Rose

The former Lindbergh residence, High Fields, is situated on a diabasic sill known as Sourland Mountain. Prolific outcrops of this rock are found on its crest and shoulders. The southeast face of the ridge is Lockatong formation sedimentary rock, consisting of layers of reddish-brown and gray sandstones, siltstones and shales.

The USDA memorandum provides a basic analysis of the soil in the vicinity of the house. It describes the clay materials as platy, indicating that the clay, silt & sand particles have separated during deposition into standing water. The properties of the clay suggest that it is predominantly micaceous in origin, probably biotite. The silt & sand mineralogy includes plagioclase feldspar, biotite, quartz and manganese concretions. The feldspar is noted to be more sodic than calcic, such as albite, andesine or oligoclase. The biotite is decomposed and identifiable only by its structure and optical properties. The quartz is found in exceptionally small quantity. The description of Sample No. 1 infers that the indigenous quartz particles are smaller than those of the questioned soil.

Sample No. 9, a small rock picked out of the High Fields soil (Sample No. 8) is described as 'diabasic in character' and typical of the soil in which it was found. The essential minerals of diabase are plagioclase feldspar (most commonly labradorite), pyroxene (diallage, augite, or orthopyroxene), hornblende, and olivene. Accessory minerals may include biotite, quartz, magnetite, ilmenite, chromite, pyrope, spinel, apatite, hematite, rutile, titanite and corundum.

The Soils of New Jersey map (Tedrow, 1962) indicates that the soil type in the vicinity of the former Lindbergh residence is a mesic Ultic Hapludalf in the Montalto series. The Official Soil Description describes the typical example of this soil as a fine, mixed soil formed in the residuum from basic igneous rocks, most commonly diabase or gabbro. The surface horizon, typically 0 - 7 inches in depth, is a 'brown silt loam; weak fine granular structure; friable, slightly sticky; many fine and medium roots; medium acid; abrupt smooth boundary'. The underlying horizons graduate from dark red silty clay loam with weak fine subangular blocky structure in the typically 7 - 11 inch horizon to yellowish red loam, massive non-structural form, in the typically 52 - 62 inch horizon. At individual sites, the solum may or may not be this deep. Observations in the field suggest that the depth to bedrock at High Fields may be significantly less.

Soil sample HF1 was collected from a point 35 feet east of the southeastern corner of the house. The soil color is moderately dark brown with a slightly reddish hue. It is silt loam with granular structure. The silt & sand mineralogy includes pyroxene, quartz, plagioclase feldspar, hornblende, calcite, olivene and biotite. Approximately 6% of the particles could not be identified due to their very small size and extremely weathered condition, however, most appear to correspond with the identifiable particles. It should be noted that a few of the unidentified particles are partially covered with a black coating having the general appearance of manganese. No muscovite, epidote or tourmaline was found within the silt & sand particles. The silt & sand particles range from extremely fine to medium, predominantly fine. The quartz particles were predominantly extremely fine (visible under 400X magnification). The soil sample included approximately 8% gravel consisting primarily of diabase and arkosic sandstone. The soil sample contained approximately 1% organic matter.

The absence of muscovite, epidote and tourmaline in soil sample HF1 suggests that these minerals are components of the questioned soil rather than the soil of the yard. The presence of hornblende in soil sample HF1 suggests that the some or all of the hornblende in USDA Sample No. 2 may have originated in the yard.

As previously noted, the USDA memorandum describes the soil structure in Sample No. 8 (High Fields) as platy. In light of the NRCS Official Soil Description and the analysis of soil sample HF1, it would appear that this was a temporary, highly-localized condition, probably attributable to the exposed and ungraded soil in the vicinity of the house and recent seasonal rains.

The Soils of New Jersey map (Tedrow, 1962) indicates that the soil type in the immediate vicinity of Featherbed Lane, southeast of the former Lindbergh residence, is a mesic Ultic Hapludalf soil in the Penn series. The Official Soil Description (OSD) describes the typical example of this soil as a fine-loamy mixed soil formed in the residuum of noncalcareous reddish shale, siltstone, and fine-grained sandstone normally of Triassic age. The surface horizon, typically 0 - 8 inches in depth, is a 'dark reddish brown channery silt loam; weak fine and medium granular structure; friable, nonsticky, slightly plastic; many roots; many pores; 10 percent shale and siltstone fragments; slightly acid; clear wavy boundary'. Solum thickness ranges up to 34 inches. Channery refers to typically flat rock fragments, such as fragments of shale or slate.

Sample HF2 was collected approximately 10 feet north of Featherbed Lane at a point approximately .7 mi. west-southwest of its intersection with Lindbergh Road. The soil color is dark brown with a slightly reddish hue. It is silt loam with a granular structure. The silt and sand particles ranged from extremely fine to medium, predominantly very fine. The silt & sand mineralogy includes pyroxene, plagioclase feldspar, quartz, hornblende and calcite. Approximately 8% of the sand & silt particles could not be identified due to their very small size and extremely weathered condition.

Most of the unidentified particles appear to correspond with the identified particles. It should be noted that a few of the unidentified particles have an unidentified yellowish encrustation. The few remaining unidentified particles were light brown or gray in color, with a dull lustre, and do not resemble muscovite, epidote or tourmaline. The soil sample included a small percentage of gravel consisting primarily of diabase & arkosic sandstone. The soil sample contained approximately 6% organic matter.

Sample HF3 was collected from Featherbed Lane at a point approximately .7 mi. from its intersection with Lindbergh Road (formerly the Wertzville-Stoutsburg road). It is reddish brown in color. The soil structure is weak subangular blocky. The silt & sand particles consisted almost exclusively of degraded arkosic sandstone and a small amount of gray shale, many with a dull yellowish encrustation. The soil sample included approx. 20 - 25% gravel, primarily arkosic sandstone. An accurate particle count could not be performed. However, none of the sandstone or shale particles appeared to contain hornblende, muscovite, epidote or tourmaline. It is apparent that this soil originates almost entirely from the Lockatong Formation sedimentary rocks. Sample HF3 is not included on the attached chart. This soil would be easily observed to be different from the soil of the yard due to its particularly reddish color and the abundance of degraded sandstone particles. Given that these characteristics are not noted in the USDA memorandum, it would appear that the ladder was not set down in Featherbed Lane.

The northwestern face of the ridge known as Mount Rose is lined with the reddish-brown and gray sandstones, siltstones and shales of the Passaic Formation. The site at which the body identified as that of Charles A. Lindbergh, Jr., was found is located a short distance downhill from the seam between the diabase and the sedimentary rock. The Soils of New Jersey map (Tedrow, 1962) identifies the soil in this vicinity as a mesic Ultic Hapladalf in the Penn series, identical to the Featherbed Lane location shown above.

Soil Sample MR1 was collected from the site at which the body was found. The soil is moderately dark brown with a slightly reddish hue. It is a silt loam with granular structure. The sand particles range from fine to medium, predominantly fine. The sand & silt particles consist of quartz, plagioclase feldspar and pyroxene. Approximately 36% of the particles were fine to medium, partially degraded reddish brown sandstone. The soil sample contained approximately 3% organic matter. It is clear that this soil originates from both the diabase and the Passaic Formation sedimentary rock.

Origin of the Questioned Soil

Based upon the descriptions of USDA Sample No.s 1 & No. 2 and our knowledge of the Lindbergh soil, we can define the questioned soil as follows: It is a soil 'of the general character' of a sandy loam with a granular structure. The silt & sand particles include quartz, possibly hornblende, and muscovite, with traces of epidote, tourmaline and calcite. The quartz is abundant, clean & clear in appearance and the particles are larger than those of the Lindbergh soil. The muscovite is 'fairly fresh', indicating proximity to its parent bedrock. It should be noted that the term 'trace' indicates an amount less than 1% of the total particulates. In a typical sandy loam, a 'trace' may include up to 9800 particles per cubic inch of soil.

Much of the region is underlain by layers of rock which consist of quartz, hornblende, muscovite, epidote, tourmaline, calcite and other minerals. In most areas, these layers are deeply buried beneath layers of younger rock and contribute no minerals to the solum. However, examination of the available soil and mineralogical data leads one to identify an extensive area in which these minerals are commonly found within the bedrock and soils. It is a long swath which includes the New Jersey Highlands, Hudson

Highlands, the Manhattan Prong, and parts of the Berkshire and Taconic Mountains of northwestern Connecticut and western Massachusetts.

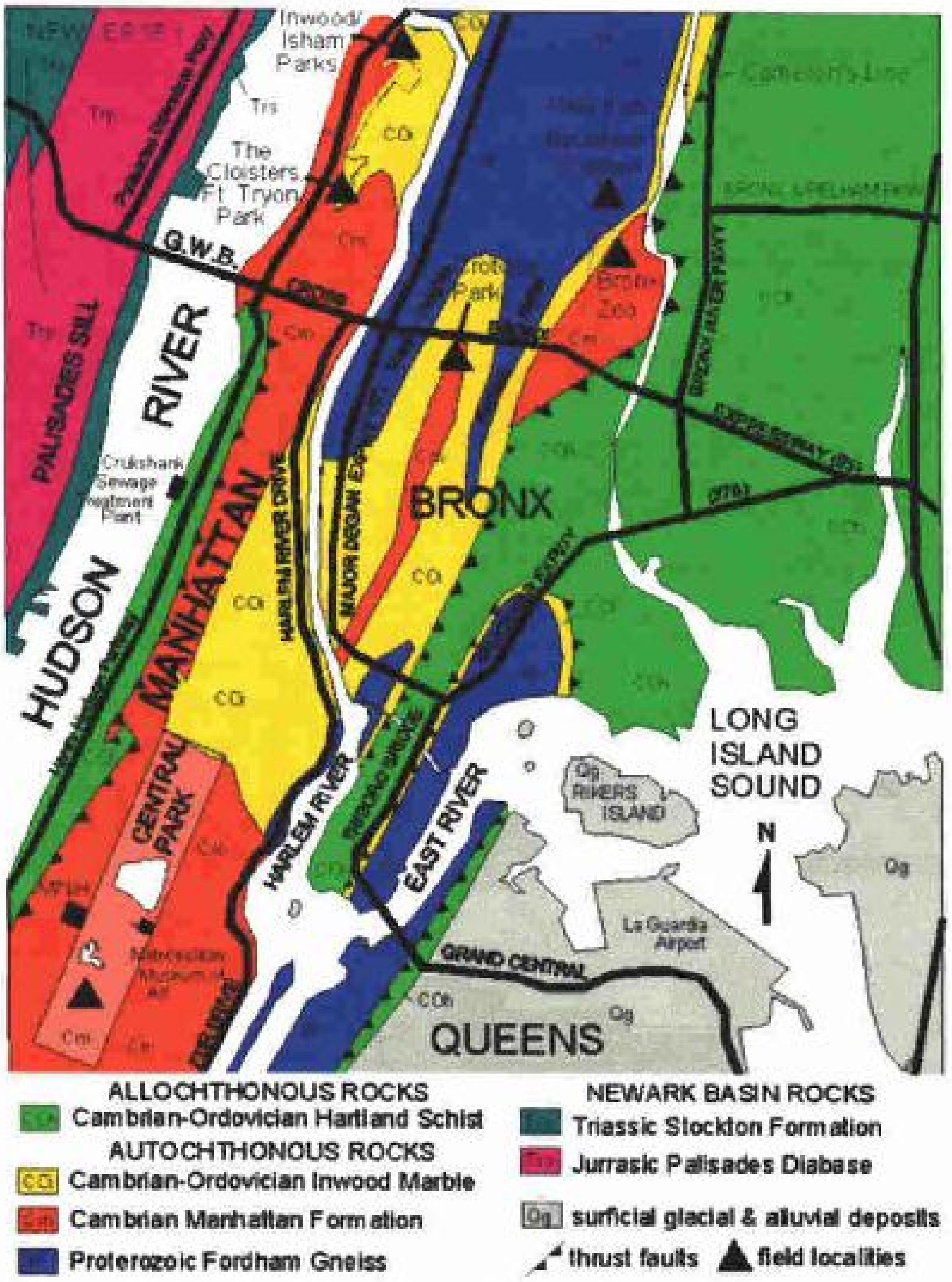

Figure 1 Bedrock geology of the Bronx & Upper Manhattan *(Courtesy of the U. S. Geological Survey)*

Manhattan, the Bronx and Westchester County are situated on the Manhattan Prong. This area is underlain by Proterozoic gneisses and Cambrian schists with very similar mineralogy. (See Figure 2) These rocks bear all of the minerals listed in the USDA memorandum, in various combinations and proportions. This entire area should be considered very high on the list of possible sites at which the questioned soil may have originated.

No soil samples were collected in the vicinity of the Plymouth Apartments, 537 W. 149th St. This address was the address given on the J. J. Faulkner deposit slip which involved the exchange of $2980 in ransom bills in 1933. The geologic and topographic environment are sufficient to reach a conclusion without analysis of a soil sample. This site is situated near the crest of a ridge which rises 120 feet in the distance of approximately four blocks. The soil texture cannot be expected to be sandy loam, which is commonly associated with low-lying areas. The underlying bedrock is upper unit Manhattan schist, which, in this vicinity, is known to be slabby to well-laminated quartz-muscovite-biotite schist. No amphibolitic layers are noted in this vicinity. In nearby Riverside Park, I observed that exposed soil literally glittered with muscovite and biotite flakes. The soil texture and the excessive amounts of muscovite and biotite (as compared with the questioned soil) suggest that the questioned soil did not originate in the vicinity of the Plymouth Apartments.

gneiss

marble

(photos courtesy of the Govt. of British Columbia, Ministry of Energy & Mines)

The former site of the Temple of Divine Power, 164 E. 127th St., operated by Rev. Peter J. Birrittella, is underlain by Inwood marble. At nearby Mount Morris Park, a remnant of middle unit Manhattan schist is found in outcrop, with exposures of the underlying Inwood marble on the southeast side.

Soil Sample PB1 was collected approximately 12 feet south of E. 127th St. at a point approximately 40 feet from its intersection with Lexington Ave.. The soil is a light reddish brown in color. It is loamy sand with a granular structure. The silt & sand particles range from extremely fine to very coarse, predominantly medium. The silt & sand mineralogy includes quartz, potassium feldspar, calcite, muscovite, hornblende, plagioclase feldspar, tourmaline, biotite, epidote and tremolite with traces of chalcedony, ferrous oxide, garnet, zircon and kyanite. Approximately 4% of the particles could not be identified due to their very small size and highly-weathered condition. The soil contained approximately 15% gravel, including numerous particles of Inwood marble.

No soil samples were collected in the vicinity of the former residence of Mary Cirrito Birrittella, 324 E. 114th St.. However, the geologic and topographic environment are identical to that of Soil Sample PB1.

The soil samples collected on E. 127th St. clearly consist of the residue of both eroded Manhattan schist and Inwood marble. The excessive amounts of calcite and the greater amount of potassium feldspar than plagioclase feldspar suggest that the questioned soil did not originate in the vicinity of Rev. Peter J. Birrittella's spiritualist church or in the vicinity of Mary Cirrito Birrittella's residence.

All of the NRCS soil surveys for Bronx County list quartz, hornblende, muscovite, and epidote or amphibolite in various proportions. Only one does not also list tourmaline. Soil textures range from silt loam to sandy loam and all show granular structure in the uppermost horizon, except one which lists the structure as subangular blocky.

The former residence of Dr. John F. Condon is underlain by Fordham gneiss. Several small gneissic specimens were collected in the vicinity.

Soil Sample JC1 was collected approximately 25 feet due north of Mosholu Parkway South at a point approximately 60 feet west of Webster Ave., the Bronx. The soil is moderately dark brown. It is loam with a granular structure. It may be noted that the soil texture at this site is within 1% of being designated sandy loam. The silt & sand particles range from fine to coarse, predominantly medium. The silt & sand mineralogy includes quartz, hornblende, potassium feldspar, muscovite, plagioclase feldspar, calcite, epidote & tourmaline with traces of aragonite, beryl, chalcedony, garnet, glass, sillimanite, and zircon. Approximately 11% of the particles could not be identified due to their very small size and highly-weathered condition. Most of the muscovite flakes have highly-weathered edges. The quartz particles consisted primarily of smoky quartz, with a lesser amount of milky quartz. A large percentage of the quartz particles can be described as 'clean & clear', although a significant number of the milky quartz particles contained reddish-brown inclusions and a few of the smoky quartz particles contained black intrusions. The soil sample included approximately 2% organic matter.

The absence of 'fresh' muscovite, the significant number of quartz particles with inclusions suggest that the questioned soil did not originate in the vicinity of Dr. John F. Condon's residence.

Manhattan schist at The Cloisters *(courtesy of the U. S. Geological Survey)*

The laminar structure is evident in this specimen of biotite schist *(Courtesy of Darryl Maddox, Amarillo College)*

The former residence of Bruno R. Hauptmann, 1279 E. 222nd St., is underlain by upper unit Manhattan schist. A specimen of schist was collected at the site where Soil Sample BH1 was collected. Specimens of both schist and gneiss found within this unit were collected at the construction site at 1277 E. 222nd St.

Soil Sample BH1 was collected from a vacant lot on Needham Ave. appromixately halfway between E. 222nd St. and E. 223rd St., the Bronx. The soil is dark reddish brown in color. It is a silt loam with granular structure. The silt & sand particles ranged from very fine to coarse, predominantly medium. The silt & sand mineralogy includes quartz, plagioclase feldspar, hornblende, muscovite, biotite, epidote & tourmaline with traces of kyanite, sillimanite and vermicullite. Approximately 2% of the particles could not be identified due to their very small size and highly-weathered condition. One piece of non-indigenous limestone (roadpack CA-6), which corresponds to nearby gravel, was found within the soil sample . The soil sample included a few partially degraded books of muscovite. Most of the quartz particles found within the sample can be described as 'clean & clear', although a small percentage contained reddish-brown inclusions. The soil sample included approximately 5 - 10% fine gravel. The soil sample also included approximately 5% organic matter.

Were it not for the soil texture, Soil Sample BH1 could be considered similar to the questioned soil. However, to increase the texture of the soil from its present texture to a sandy loam would require the incorporation of additional sand amounting to at least 10% of the total soil. This would certainly be possible. Additional field work will be required to resolve this issue.

In the Bronx, sandy loams and loamy sands are primarily found in the lowlands along the lower reaches of the Bronx and Westchester Rivers, in the Webster Avenue lowlands. There are no significant rock outcrops along the lower reaches of the Westchester River. Those along the Bronx River are generally within (or above) Bronx Park or adjacent to the Cross Bronx Expressway, well upstream from the areas in which sandy loam is found. The Webster Avenue lowlands are the former course of the Bronx River, which was diverted (at a point just above the Snuff Mill Gorge) during the late Pleistocene. This area is noted to be underlain by Inwood marble with a thin layer of glacial till. While these lowlands cannot adequately be delineated by streets, the prominent outcrops of gneiss and/or schist at Echo Park, Claremont Park, the grounds of the Daughters of St. Jacob Hospital, Franz Sigel Park and the Mott Yard mark its western limits and outcrops of schist at Boro Hall Park, Crotona Park, vacant lots on the eastern side of St. Ann's Avenue between E. 155th St. & E. 158th St. and at St. Mary's Park mark its eastern limits. These outcrops have contributed an abundance of minerals, including 'fresh' muscovite, to the solum near the base of the slopes on which they are found.

The former residence of Isidor Fisch, 532 E. 157th St., lies on the eastern edge of the Webster Avenue lowlands. Fisch occupied an apartment at this address from Dec. 2, 1925 until April 23, 1932. One block to the east, across St. Ann's Avenue, lie the aforementioned outcrops of Manhattan schist.

Soil Sample IF1 was collected from a vacant lot on the northwest corner of E. 157th St. and Brook Ave., the Bronx. The soil is grayish brown in color. It is a sandy loam with granular structure. The silt & sand mineralogy includes quartz, plagioclase feldspar, hornblende, potassium feldspar, muscovite, biotite, ferrous oxide & kyanite with traces of beryl, calcite, epidote, garnet, pyroxene, tourmaline, sillimanite and zircon. Approximately 2% of the particles could not be identified due to their very small size and highly-weathered condition. The silt & sand particles range from very fine to very coarse, predominantly medium. The soil sample included approximately 5% fine gravel. The soil sample also included approximately 2% organic matter. The gravel included several partially degraded pieces of schist with muscovite & biotite still embedded and a large percentage of the individual muscovite particles within the silt & sand showed clean, sharp edges. The biotite particles were well-weathered. With few exceptions, the quartz particles were exceptionally 'clean & clear'.

Soil Sample IF1 can be considered the closest match to the description of the questioned soil as given in the USDA memorandum. The soil texture is 'of the general character of a sandy loam'. The soil structure is granulated, or 'heterogenously aggregated'. The silt & sand particles contained quartz, hornblende, muscovite, epidote, tourmaline and calcite in proportions which one would expect from the USDA description of Samples No. 1 & No. 2. Quartz is found in larger quantity, and as larger particles, than that of the High Fields soil. They are also 'clean & clear'. The muscovite particles are 'fairly fresh'. In addition, the predominant feldspar within these samples is plagioclase feldspar. If found within the mixed soil of Sample No. 2, it would not normally be differentiated from the plagioclase feldspar in Sample No. 8.

This report should by no means be interpreted as conclusive evidence of Isidor Fisch's involvement in the kidnapping and murder of Charles A. Lindbergh, Jr.. There is nothing within the components of the soil which link it directly to a specific individual. There is, however, a very high probability that the questioned soil originated within the Webster Avenue lowlands.

ANALYSIS OF SOIL SAMPLES

LOCATION	CLAY (Percent)	SILT (Percent)	SAND (Percent)	SOIL STRUCTURE	QZ	HN	MS	EP / AM	TM	CA	ADDITIONAL
Questioned Soil (upper end of ladder)		Sandy loam		aggregated (granular)	'larger qty. than no. 8'	Yes	'not plentiful but distinct'	'fare particles'	Tr	Tr	
USDA No. 8 (High Fields yard)		?		platy	'exceptionall small qty.'	No	No	No	No	Tr	FP, MN, BT
HF1 High Fields, yard	3	64	33	granular	25	5	No	No	No	3	PR 48, FP 12, OT 4, OV 2, BT 1
HF2 Featherbed Lane	7	55	32	granular	20	8	No	No	No	?	PR 37, FP 27, OT 8
MR1 Mount Rose, body recovery site	5	57	35	granular	33	No	No	No	No	6	OT* 36, FP 13, PR 12 *includes siltstone particles
PB1 SE corner of E. 127 St. & Lexington Ave.	2	24	74	granular	36	6	7	1	2	17	FK 21, OT 4, FP 3, BT 2, KY 1, CD Tr, FE Tr, GN Tr, ZR Tr
JC1 Mosholu Pkwy So., W of Webster Ave.	13	38	49	granular	42	18	4	1	1	2	FK 18, OT 11, FP 3, AR Tr, BY Tr, CD Tr, GN Tr, GS Tr, SL Tr, ZR Tr
BH1 Needham Ave.	16	44	40	granular	56	13	6	1	1	*	FP 14, BT 6, OT 2, BY 1, KY Tr, SL Tr, VM Tr *non-indigenous limestone
IF1 E. 157th & Brook Ave.	4	21	75	granular	61	8	5	Tr	Tr	Tr	FP 13, FK 5, BT 4, OT 2, FE 1, KY 1, BY Tr, GN Tr, PR Tr, SL Tr, ZR Tr

ABBREVIATIONS:

AM = Amphibolite	CD = Chalcedony	KY = Kyanite	PR = Pyroxene
AR = Aragonite	EP = Epidote	MN = Manganese	QZ = Quartz
BT = Biotite	FE = Ferrous oxide	MS = Muscovite	SL = Sillimanite
BY = Beryl	FK = Potassium feldspar	OT = Other	TM = Tourmaline
CA = Calcite	FP = Plagioclase feldspar	OV = Olivene	ZR = Zircon