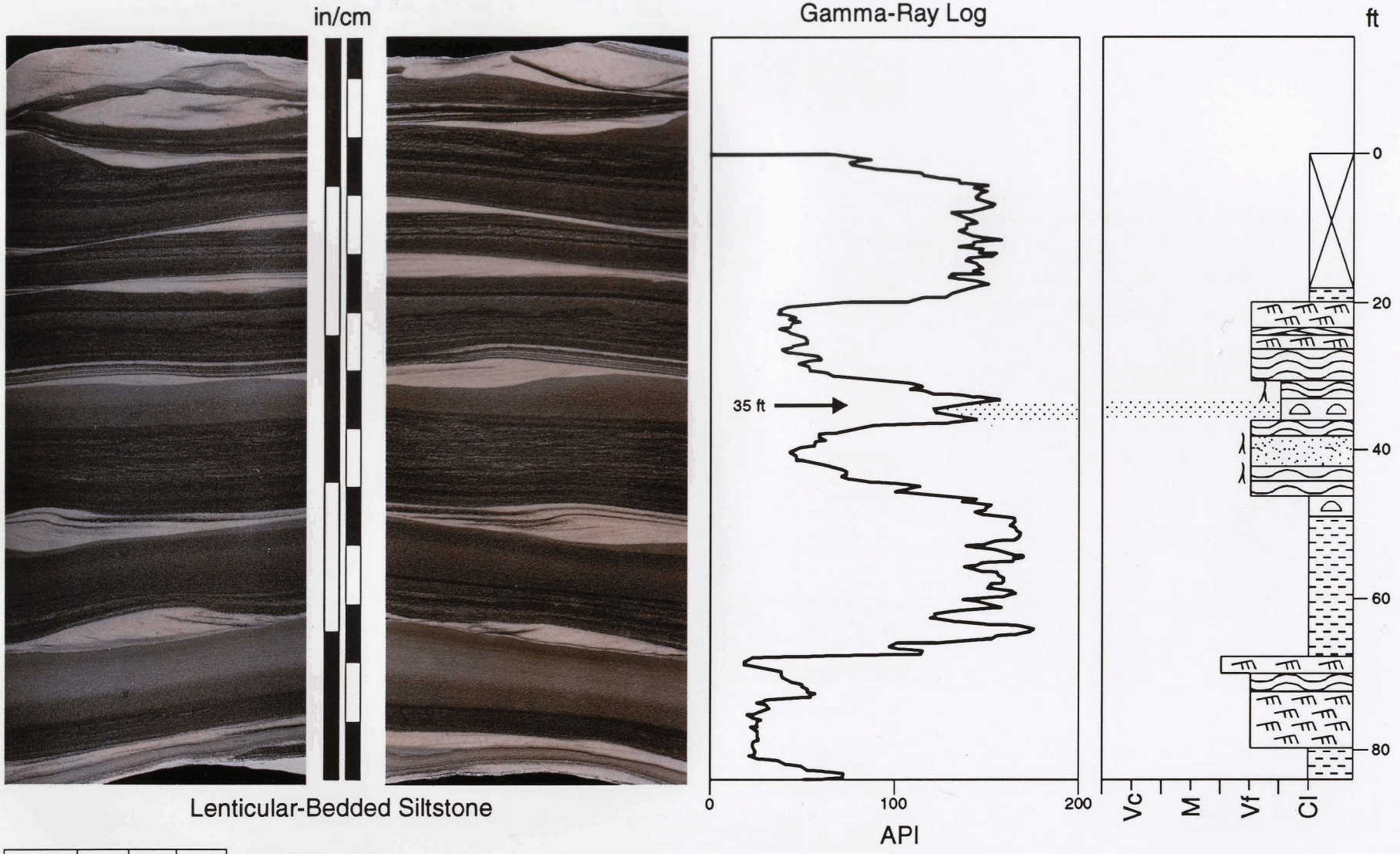
NSWC Crane IGS No. (A)4
Sec. 24 - T5N - R4W
Martin County, Indiana



Lenticular-Bedded Siltstone

Ft	I	z	1	[322.5]

Ft	I	z	1

I. NAME: Lenticular-bedded siltstone
Formation: Mansfield

II. DESCRIPTION:

Texture: **Clay and silt** – (less than 0.0625 mm)
Sand – very fine-grained (0.0625 - 0.125 mm) subangular to subrounded

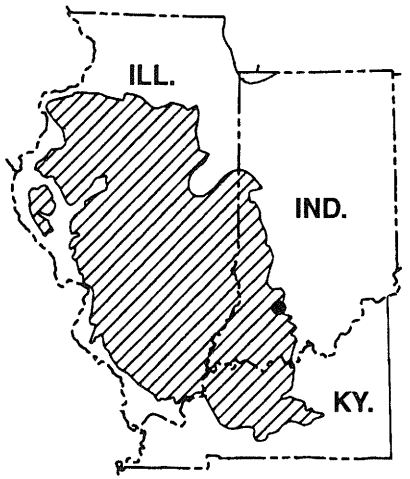
Composition: **Clay** – (unknown)
Sand and silt – quartz with silica and kaolinite cement

Sedimentary structures and features:
Lenticular bedding, minor bioturbation

Fossils: Some burrows

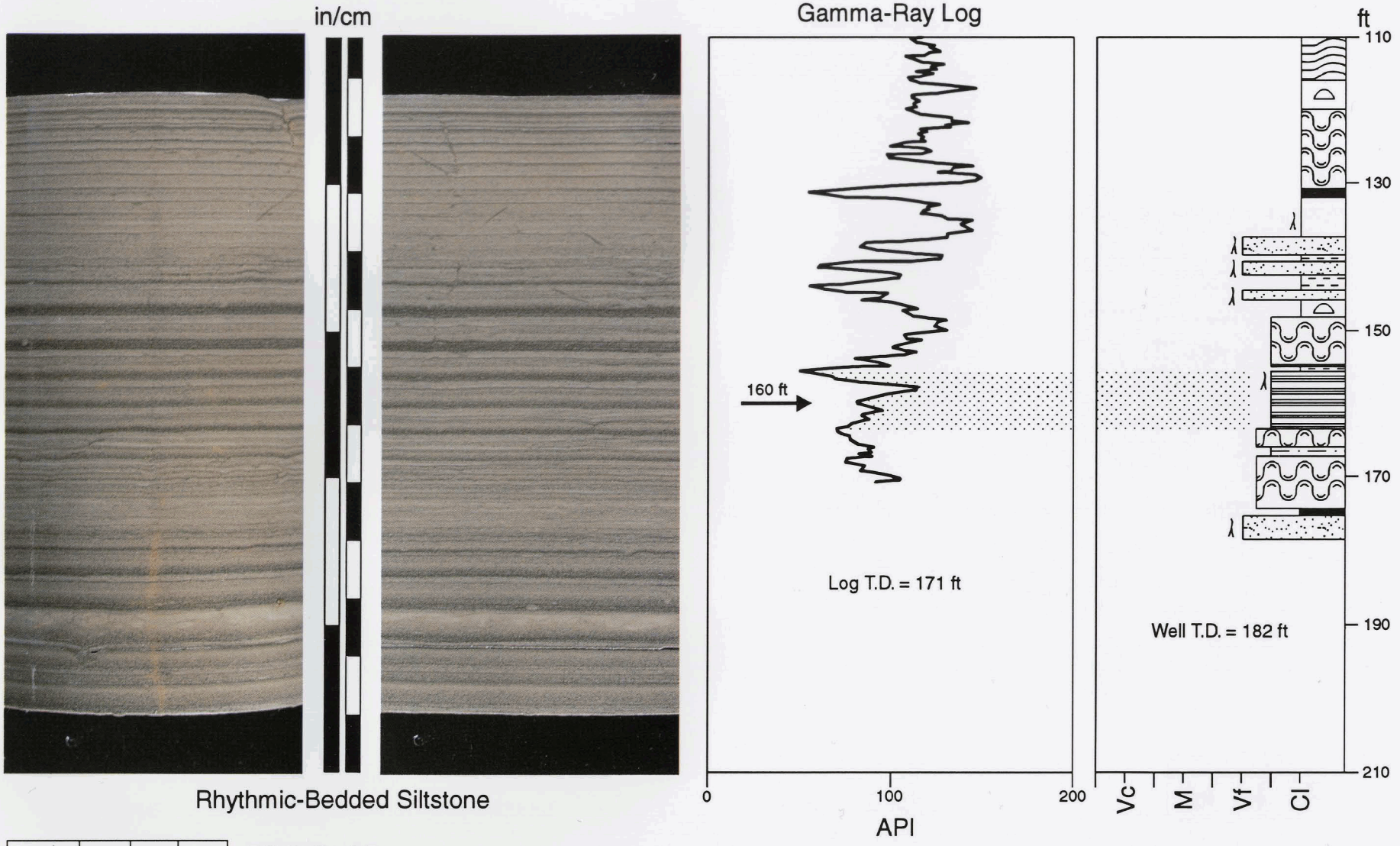
III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The stratigraphic section from the base at 83 ft to the top at 18 ft consists of several abruptly alternating lithologies of shale and very fine-grained sandstone. The result is a gamma-ray well-log that has an irregular signature.



Map showing area of Pennsylvanian rocks and location of corehole.

NSWC Crane IGS(D)5
Sec. 20 - T5N - R3W
Martin County, Indiana



Rhythmic-Bedded Siltstone

Ft	t	z	1	[322.6]

Ft	t	z	1

I. NAME: Rhythmic-bedded siltstone
Formation: Mansfield

II. DESCRIPTION:

Texture: **Silt** – (0.0039 - 0.0625 mm)
Clay – (less than 0.0039 mm)

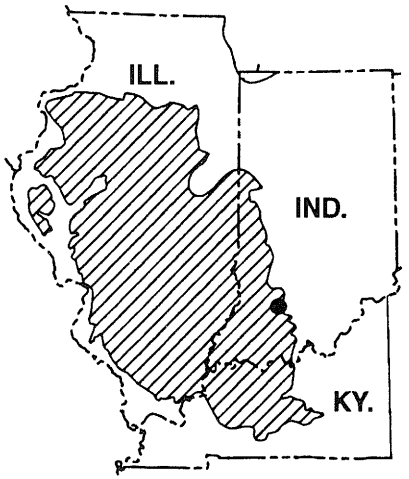
Composition: **Silt** – quartz
Clay – unknown

Sedimentary structures and features:
Rhythmic bedding, some rooting

Fossils: Fossil roots

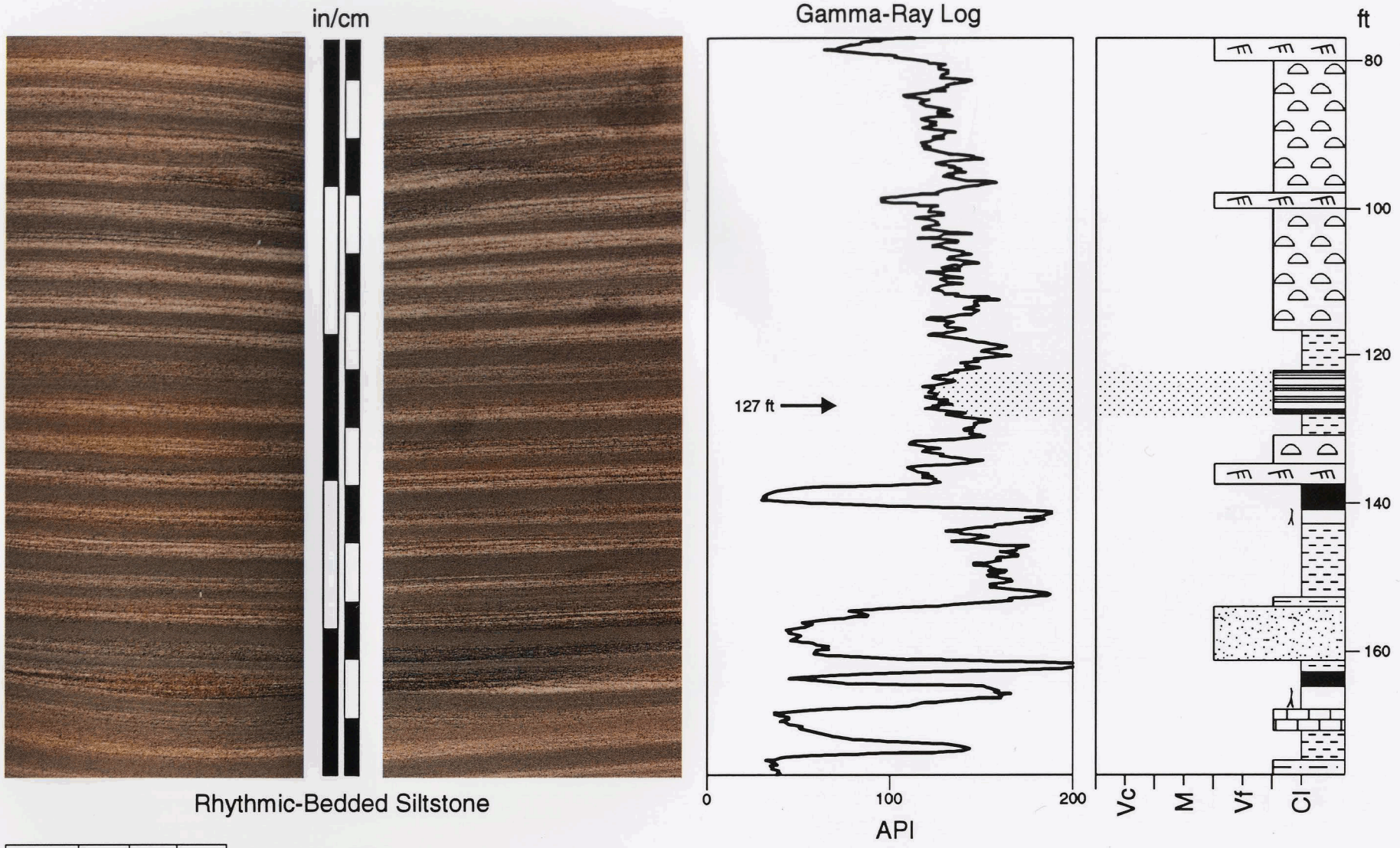
III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The presence of a significant silt-size fraction causes the gamma-ray curve to read intermediate between "clean" sandstone and shale. The alternating silt-rich and clay-rich intervals result in an irregular gamma-ray well-log signature.



Map showing area of Pennsylvanian rocks and location of corehole.

Shot Point Services EIBIND-9
Sec. 3 - T1S - R9W
Pike County, Indiana



Rhythmic-Bedded Siltstone

Ft | t | z | 2 [322.6]

Ft	t	z	2

I. NAME: Rhythmic-bedded siltstone
Formation: Brazil

II. DESCRIPTION:

Texture: **Silt** – (0.0039 - 0.0625 mm)
Clay – (less than 0.0039 mm)

Composition: **Silt** – quartz with siderite concentrated along siltstone laminae
Clay – unknown

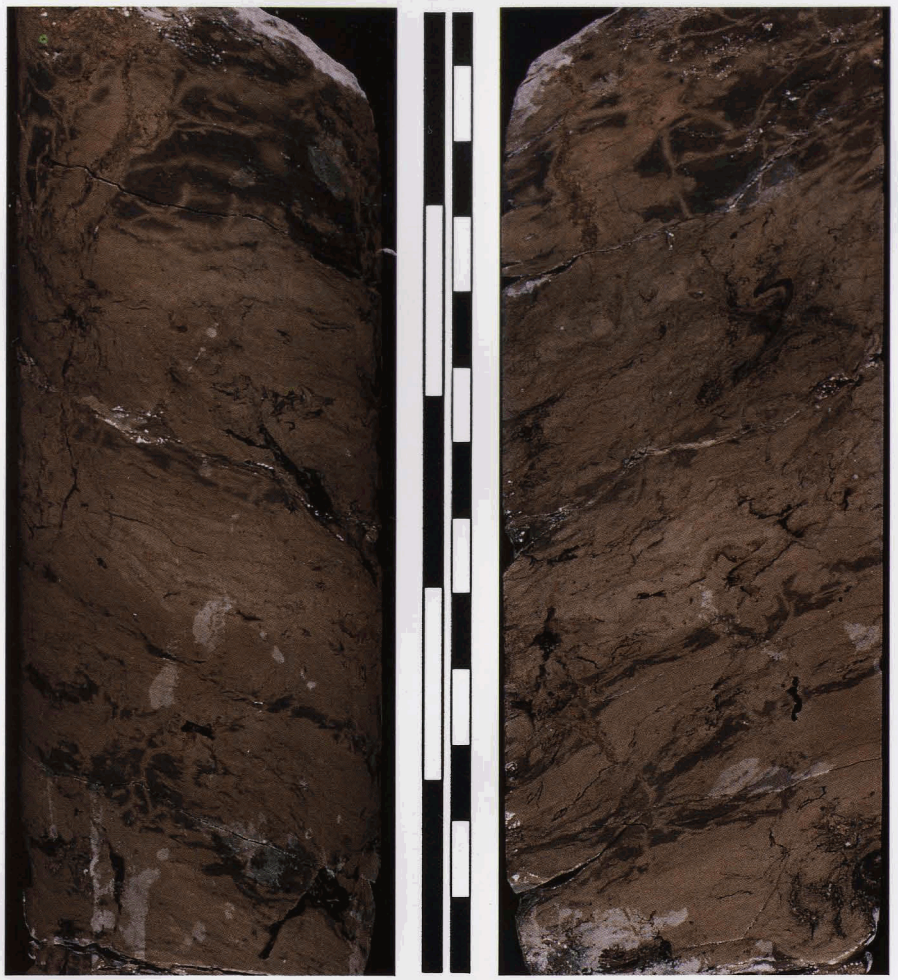
Sedimentary structures and features:
Rhythmic bedding

Fossils: None observed

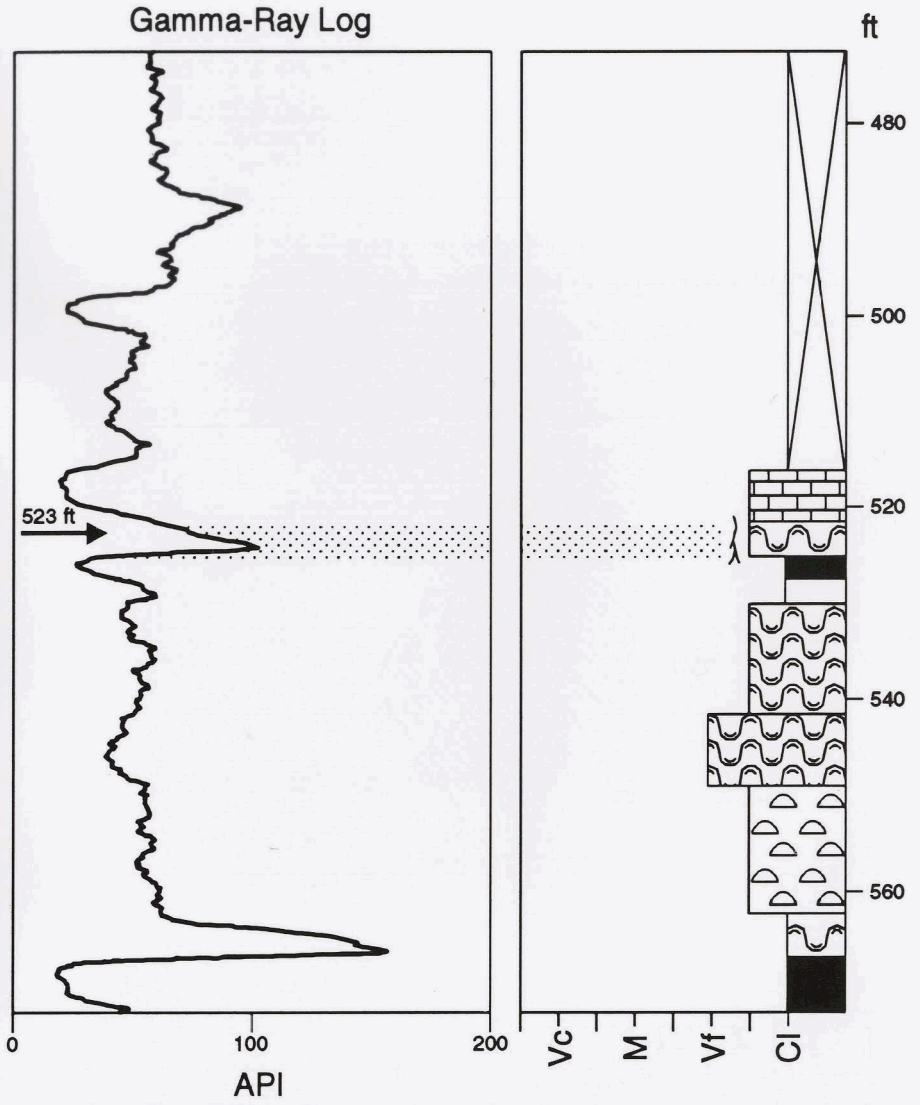
III. **GAMMA-RAY WELL-LOG CHARACTERISTICS:**
The gamma-ray well-log shows an irregular signature as a result of the abruptly changing lithologies throughout the 100 ft interval shown on the columnar profile.

Map showing area of Pennsylvanian rocks and location of corehole.

Nicor Minerals Inc. M-7
Sec. 2 - T14N - R1E
Macon County, Illinois



Disturbed-Bedded Mudstone



Fm z d 1 [010]

Fm	z	d	1

I. NAME: Disturbed-bedded mudstone
Formation: Carbondale

II. DESCRIPTION:

Texture: **Clay** – (less than 0.0039 mm)
Silt – (0.0039 - 0.0625 mm)

Composition: **Clay** – unknown
Silt – quartz, rare pyrite blebs, calcite cement filling small fractures, possible fossil fragments

Sedimentary structures and features:
Disturbed bedding, rooting

Fossils: Fossil roots

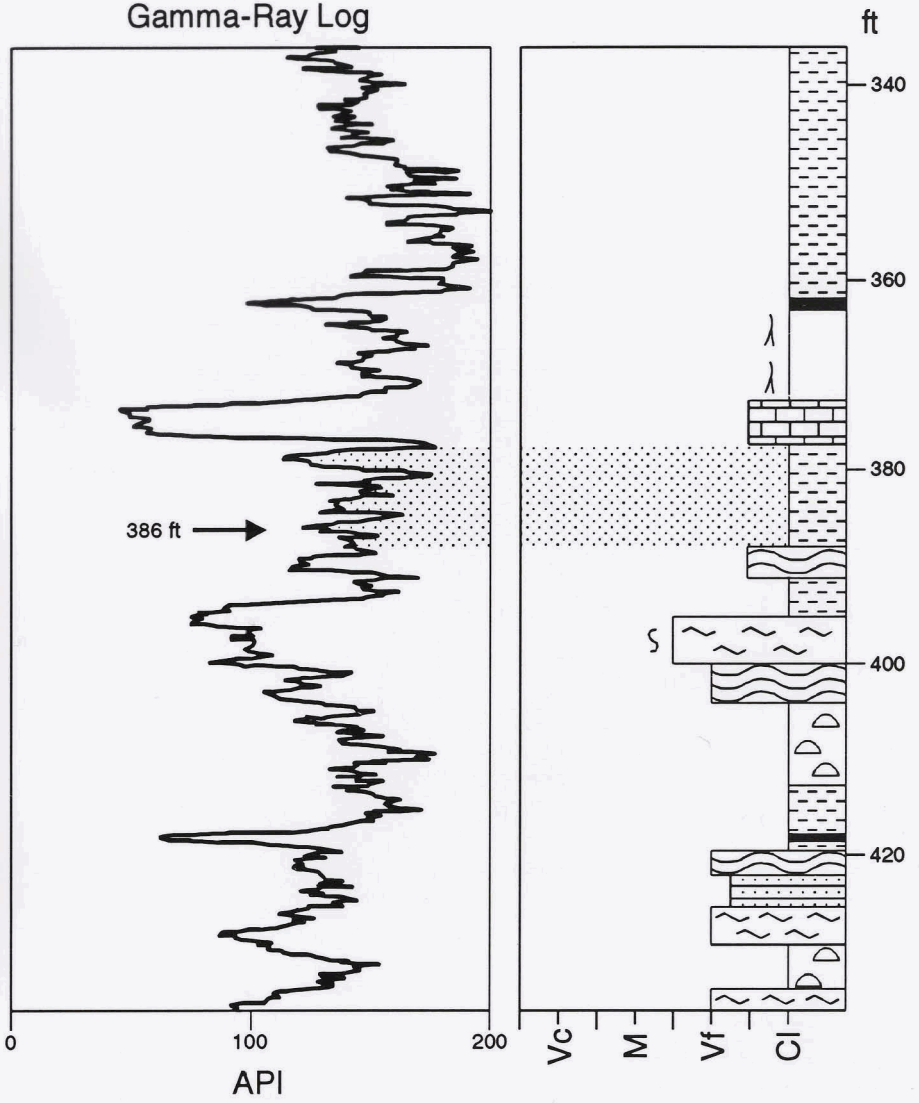
III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The presence of a radioactive shale above the lower coals (563 ft to 567 ft), and the absence of a consistent upward-coarsening or upward-fining grain-size trend, result in an irregular gamma-ray signature.

Map showing area of Pennsylvanian rocks and location of corehole.

Marathon Pipeline Test Hole No. 1
Sec. 2 - T6N - R14W
Crawford County, Illinois

Structureless Mudstone



Fm | m | z | 1 [257]

Fm	m	z	1

I. NAME: Structureless mudstone
Formation: Patoka

II. DESCRIPTION:

Texture: **Clay** – (less than 0.0039 mm)
Minor silt – (0.0039 - 0.0625 mm)
Limestone – nodular sideritic micrite

Composition: **Clay** – unknown
Silt – quartz
Nodules – limonitic carbonate

Sedimentary structures and features:
Possible rooting

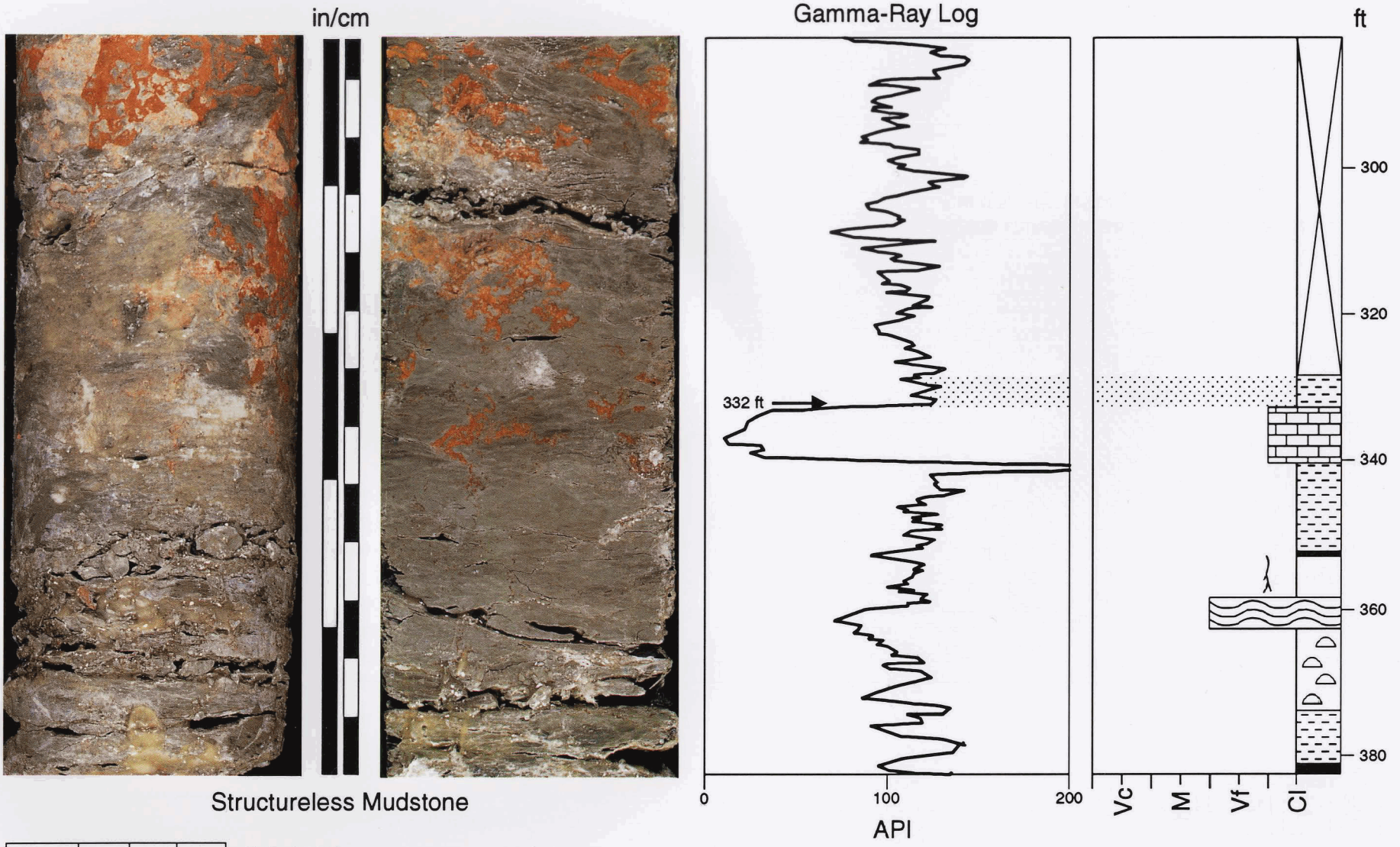
Fossils: Possible fossil roots

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The gamma-ray well-log shows a well-developed funnel-shaped signature from 417 ft to the top of the flaser-bedded sandstone at 396 ft. The consistent fine-grained nature of the interval from just above the flaser-bedded sandstone at 396 ft to the base of the limestone at 377 ft results in a high gamma count and an irregular gamma-ray signature.

Map showing area of Pennsylvanian rocks and location of corehole.

Borehole No. 571
Sec. 14 - M - 21
Webster County, Kentucky



Structureless Mudstone

Fm m z 2 [247]

I. NAME: Structureless mudstone
Formation: Bond

Fm	m	z	2

II. DESCRIPTION:

Texture: **Clay** – (less than 0.0039 mm)
Minor silt – (0.0039 - 0.0625 mm)

Composition: **Clay** – unknown; small limonitic, calcareous patches and nodules
Silt – quartz

Sedimentary structures and features:
Possible rooting

Fossils: Possible fossil roots

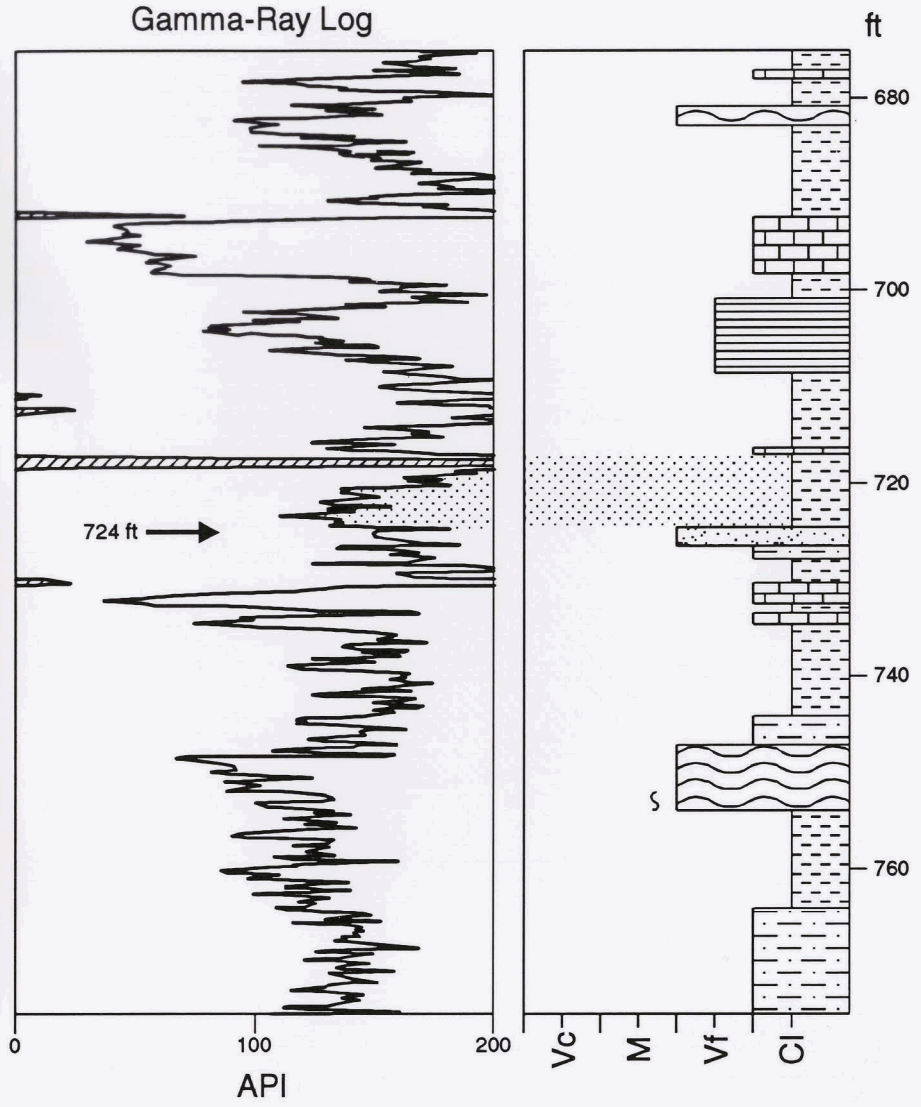
III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

With the exception of the limestone at 340 ft to 334 ft, the clay-dominated succession shown on the columnar profile results in a gamma-ray well-log curve that reads at or near the shale baseline. The gamma-ray well-log signature across the succession from the base to the top is best described as irregular.

Map showing area of Pennsylvanian rocks and location of corehole.

Borehole No. 613
Sec. 25 - M - 21
Webster County, Kentucky

Structureless Mudstone



Fm m z 3 [457]

Fm	m	z	3

I. NAME: Structureless mudstone
Formation: Shelburn (?)

II. DESCRIPTION:

Texture: **Clay** – (less than 0.0039 mm)
Silt – (0.0039 - 0.0625 mm)
Sand – fine- to very fine-grained (0.0625 - 0.250 mm) subangular to subrounded

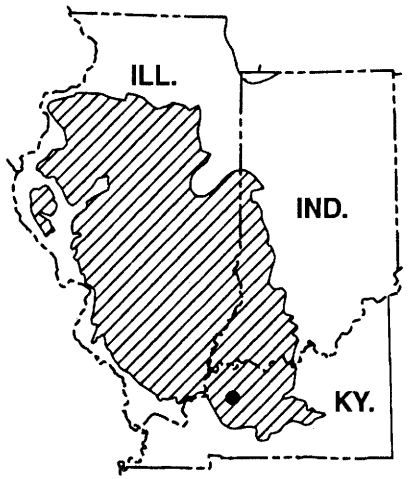
Composition: **Clay and silt** – unknown, abundant siderite and limonite
Sand – quartz sand

Sedimentary structures and features: Possible rooting

Fossils: Possible fossil roots

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

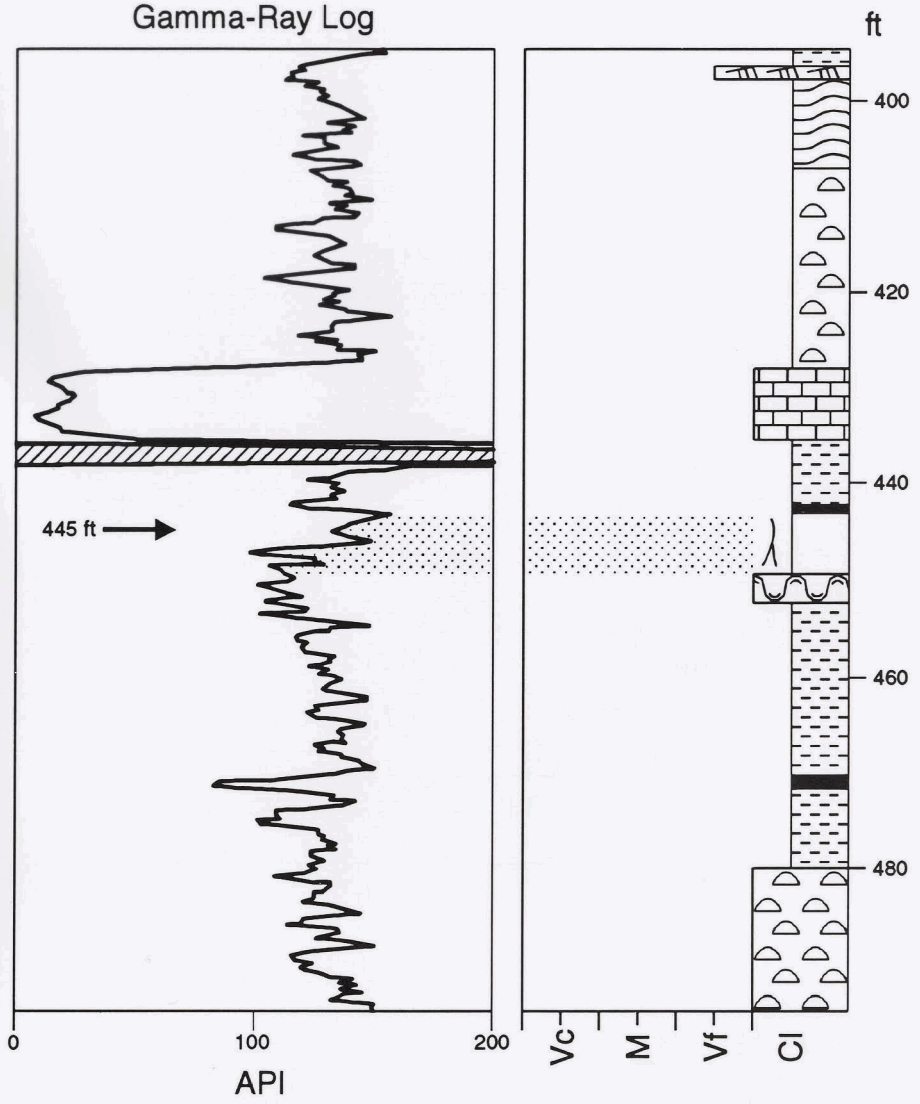
The gamma-ray well-log from the base of the columnar profile to the top represents a stratigraphic succession dominated by shale with lesser amounts of sandstone and limestone. The high gamma-ray spike at 714 ft is a radioactive black shale. The lack of a significant grain-size trend and the abrupt change in lithologies result in an irregular gamma-ray well-log signature.



Map showing area of Pennsylvanian rocks and location of corehole.

Borehole No. 593
Sec. 19 - M - 21
Webster County, Kentucky

Rooted Massive Mudstone



Fm | m | r | 1 [327]

Fm	m	r	1

I. NAME: Rooted massive mudstone
Formation: Patoka

II. DESCRIPTION:

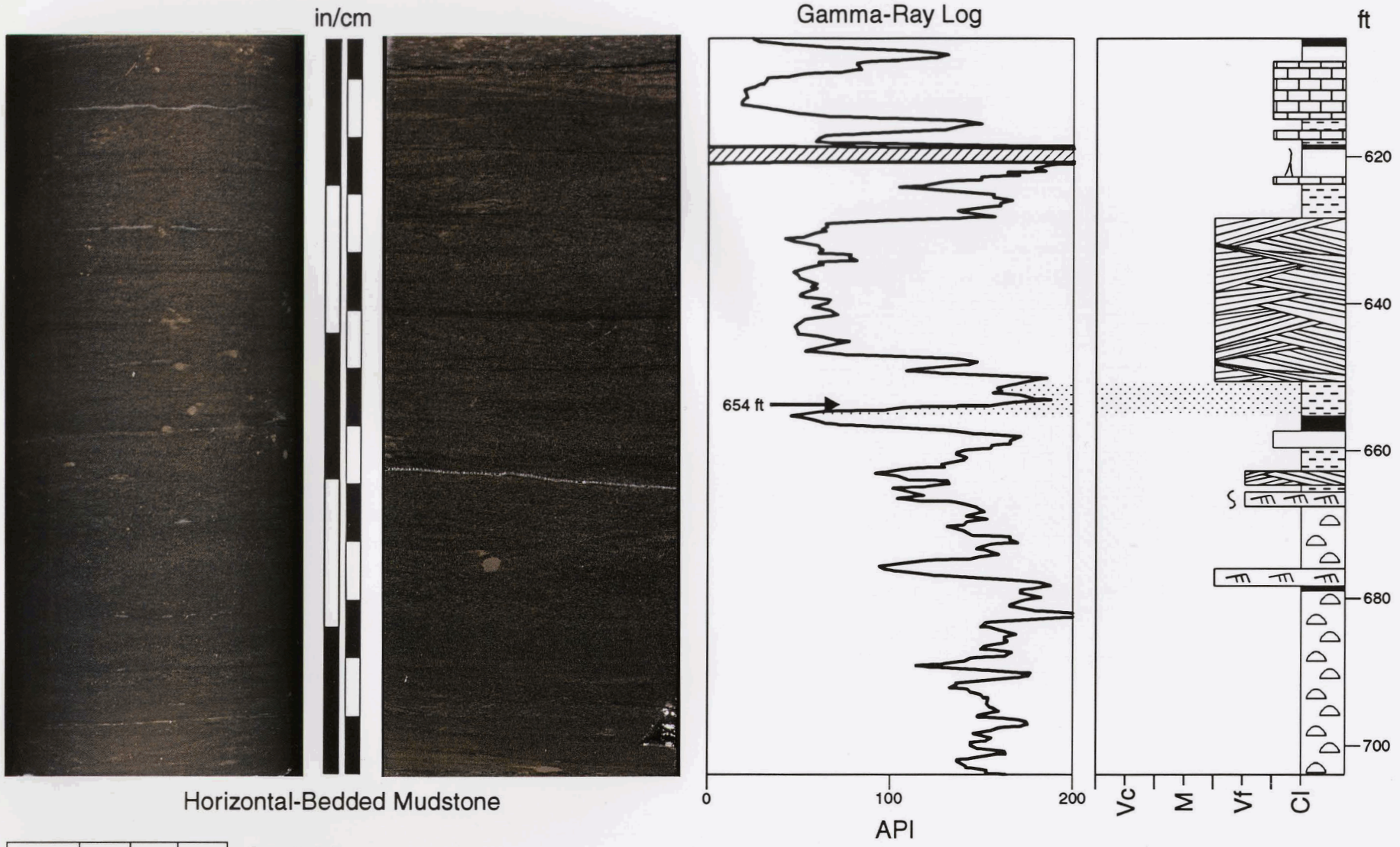
Texture: **Silt and clay** – (less than 0.0625 mm)
Composition: **Silt** – quartz with silica and siderite cement; siderite nodules common
Clay – unknown
Sedimentary structures and features: Bioturbation from rooting
Fossils: Fossil roots

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

From the base of the columnar profile at 495 ft to the base of the limestone at 435 ft, the gamma-ray well-log reads high gamma activity as a result of the predominantly fine-grained nature of the succession. The high gamma-ray spike at 435 ft is a radioactive black shale. The gamma-ray well-log shows an irregular signature across this interval.

Map showing area of Pennsylvanian rocks and location of corehole.

Borehole No. 545
Sec. 16 - M - 21
Webster County, Kentucky



Horizontal-Bedded Mudstone

Fm h z 1 [123]

Fm	h	z	1

I. NAME: Horizontal-bedded mudstone
Formation: Carbondale

II. DESCRIPTION:

Texture: **Clay** – (less than 0.0039 mm)
Silt – (0.0039 - 0.0625 mm)

Composition: **Clay** – unknown
Silt – quartz; small patches of pyrite disseminated throughout, abundant fine-grained plant material

Sedimentary structures and features:
Faint lamination

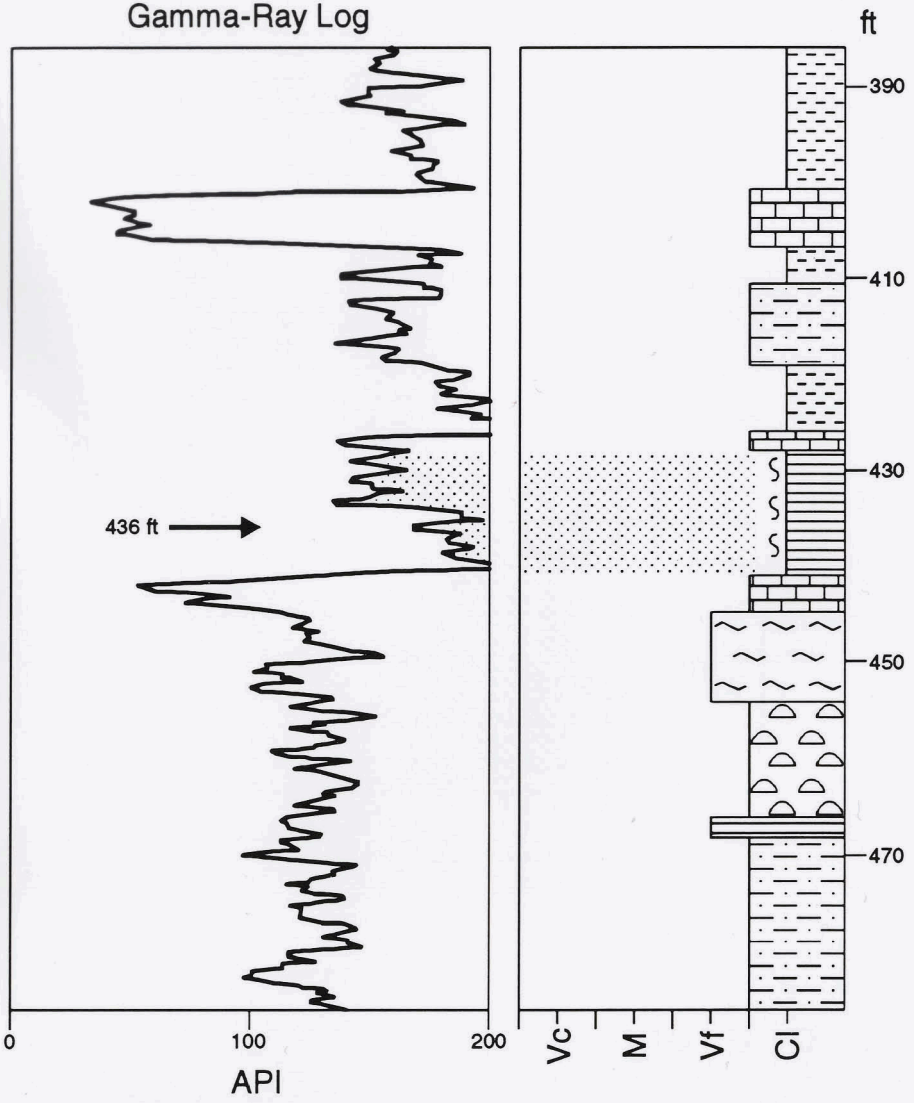
Fossils: Plant material

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The gamma-ray well-log shows two distinct signatures. From the base of the succession to the top of the shale shown on the photograph (704 ft to 652 ft) the gamma-ray well-log has an irregular signature in response to thinly interbedded coal, siltstone, shale, and sandstone. The high gamma-ray spike at 619 ft does not correspond to a black shale in the core. Its presence on the log cannot be explained. The thick cross-bedded sandstone (651 ft to 628 ft) is a good example of a cylindrical gamma-ray well-log signature.

Map showing area of Pennsylvanian rocks and location of corehole.

Borehole No. 545
Sec. 16 - M - 21
Webster County, Kentucky



Bioturbated Horizontal-Laminated Mudstone

Fm h b 1 [158]

Fm	h	b	1

I. NAME: Bioturbated horizontal-laminated mudstone

Formation: Shelburn

II. DESCRIPTION:

Texture: **Clay** – (less than 0.0039)
Minor silt – (0.0039 - 0.0625)

Composition: **Clay** – unknown
Silt – quartz

Sedimentary structures and features:
Faint horizontal lamination

Fossils: None observed

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The sharp contact with the underlying limestone results in abrupt deflection of the gamma-ray curve towards the shale baseline. The clay-rich nature of this rock causes the gamma-ray curve to read at the shale baseline. The gamma-ray curve shows an irregular signature.

Map showing area of Pennsylvanian rocks and location of corehole.