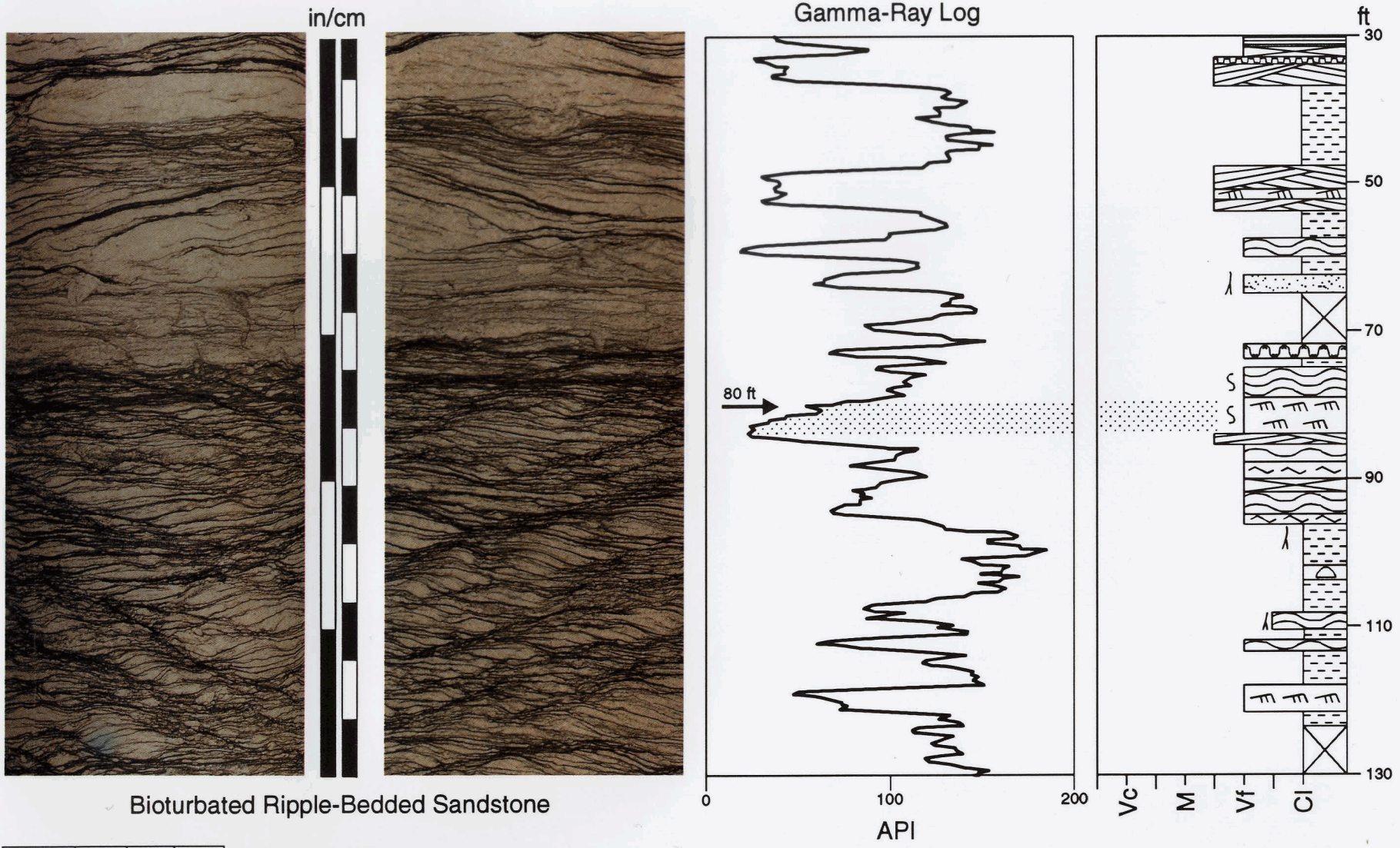
NSWC Crane IGS (F)7
Sec. 8 - T5N - R3W
Martin County, Indiana



Bioturbated Ripple-Bedded Sandstone

Ss | r | b | 1 [553.8]

Ss	r	b	1

I. NAME: Bioturbated ripple-bedded sandstone
Formation: Mansfield

II. DESCRIPTION:

Texture: **Sand** – very fine-grained (0.0625 - 0.125 mm) subangular to subrounded
Clay – (less than 0.0039 mm)

Composition: **Sand** – quartz with silica, siderite, and kaolinite cement
Clay – unknown

Sedimentary structures and features: Climbing ripples, wavy bedding, and rhythmic bedding

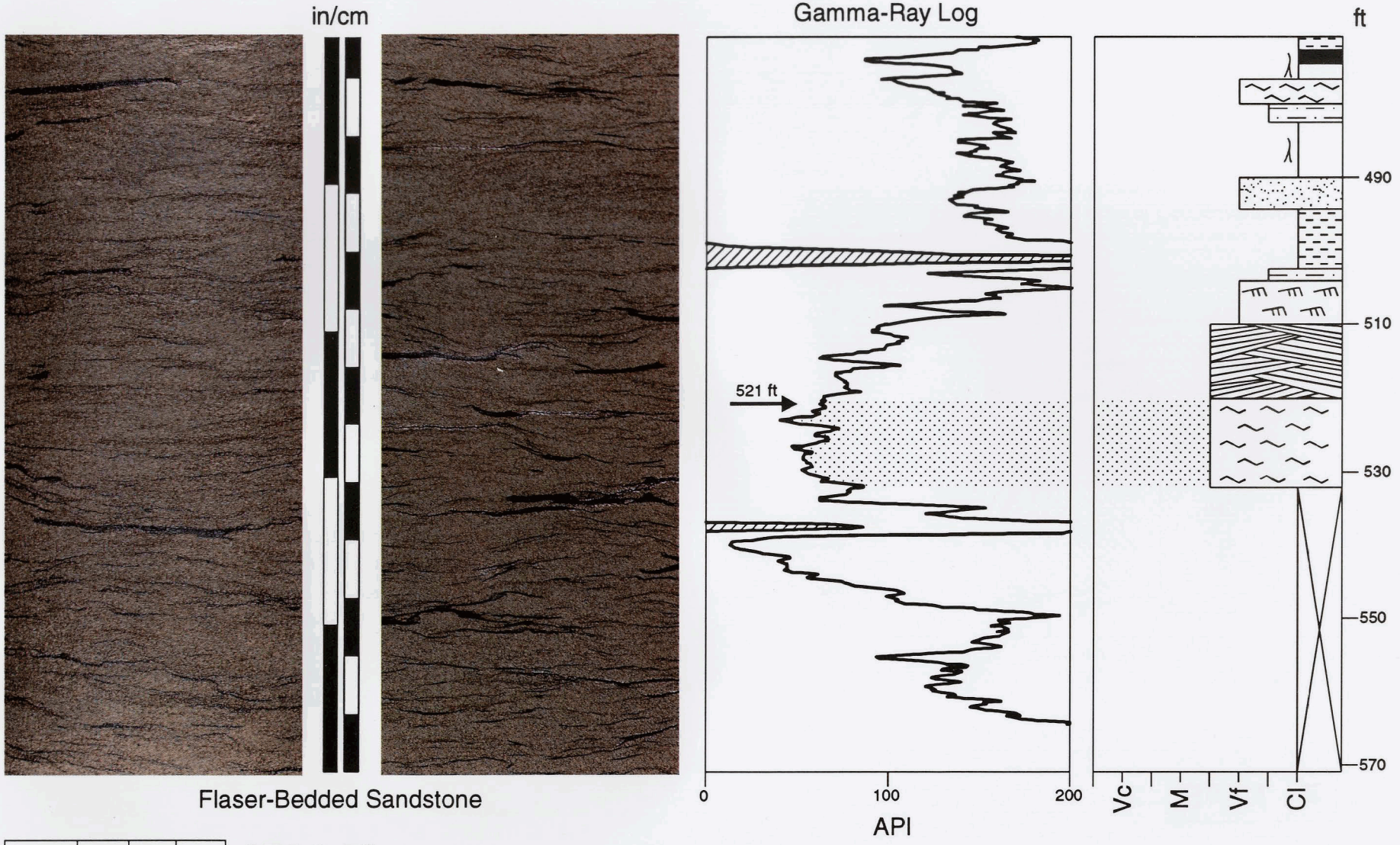
Fossils: Horizontal burrows

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

This overall sequence is dominated by very fine-grained sandstone. However, the presence of abundant clay in this particular unit results in an increase in gamma activity compared with the underlying, coarser-grained cross-bedded sandstone. The presence of thinly interbedded wavy bedding, flaser bedding, ripple bedding, and cross-bedding, each containing a different clay content, results in an irregular gamma-ray well-log signature.

Map showing area of Pennsylvanian rocks and location of corehole.

Exxon IN-4
Sec. 15 - T5S - R13W
Posey County, Indiana



Flaser-Bedded Sandstone

Ss	f	z	1	[563.5]

Ss	f	z	1

I. NAME: Flaser-bedded sandstone
Formation: Dugger

II. DESCRIPTION:

Texture: **Sand** – fine-grained (0.125 - 0.250 mm) subangular to subrounded
Clay – (less than 0.0039 mm)

Composition: **Sand** – quartz with silica, kaolinite, and siderite cement
Clay – unknown

Sedimentary structures and features: Flaser bedding

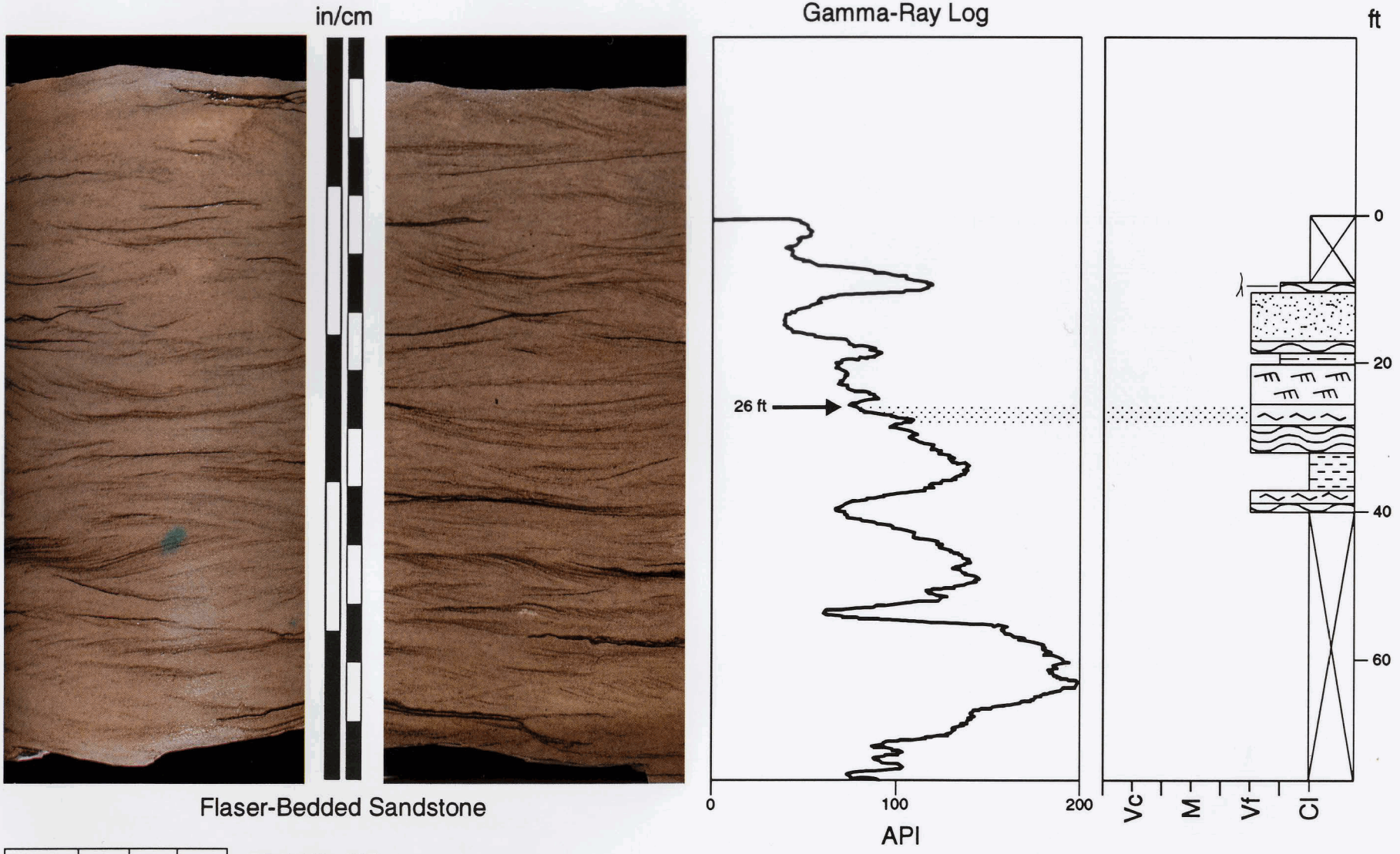
Fossils: None observed

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The flaser-bedded sandstone facies represents part of an upward-fining succession (532 to 494 ft) as shown on the columnar profile. The gamma-ray well-log suggests that this upward-fining interval actually begins at approximately 540 ft where there is an abrupt leftward deflection in the gamma-ray curve. The upward-fining succession from 540 to 494 ft results in a bell-shaped gamma-ray well-log signature. The high gamma-ray spike at 502 ft and 538 ft are probably radioactive black shales.

Map showing area of Pennsylvanian rocks and location of corehole.

USACE - WES 10-C-24
Sec. 5 - T5N - R3W
Martin County, Indiana



Flaser-Bedded Sandstone

Ss	f	z	2	[553.5]

Ss	f	z	2

I. NAME: Flaser-bedded sandstone
Formation: Mansfield

II. DESCRIPTION:

Texture: **Sand** – very fine-grained (0.0625 - 0.125 mm) subangular to subrounded
Clay – (less than 0.0039 mm)

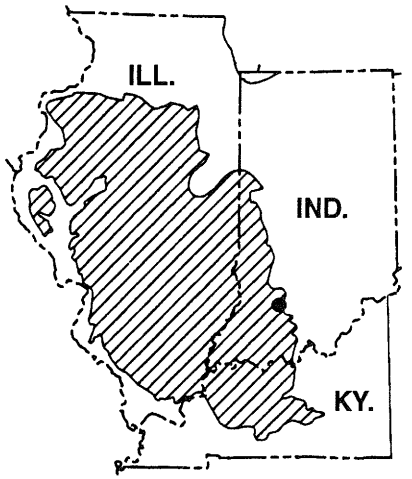
Composition: **Sand** – quartz with silica, kaolinite, and siderite cement
Clay – unknown

Sedimentary structures and features: Flaser bedding, some wavy bedding

Fossils: None observed

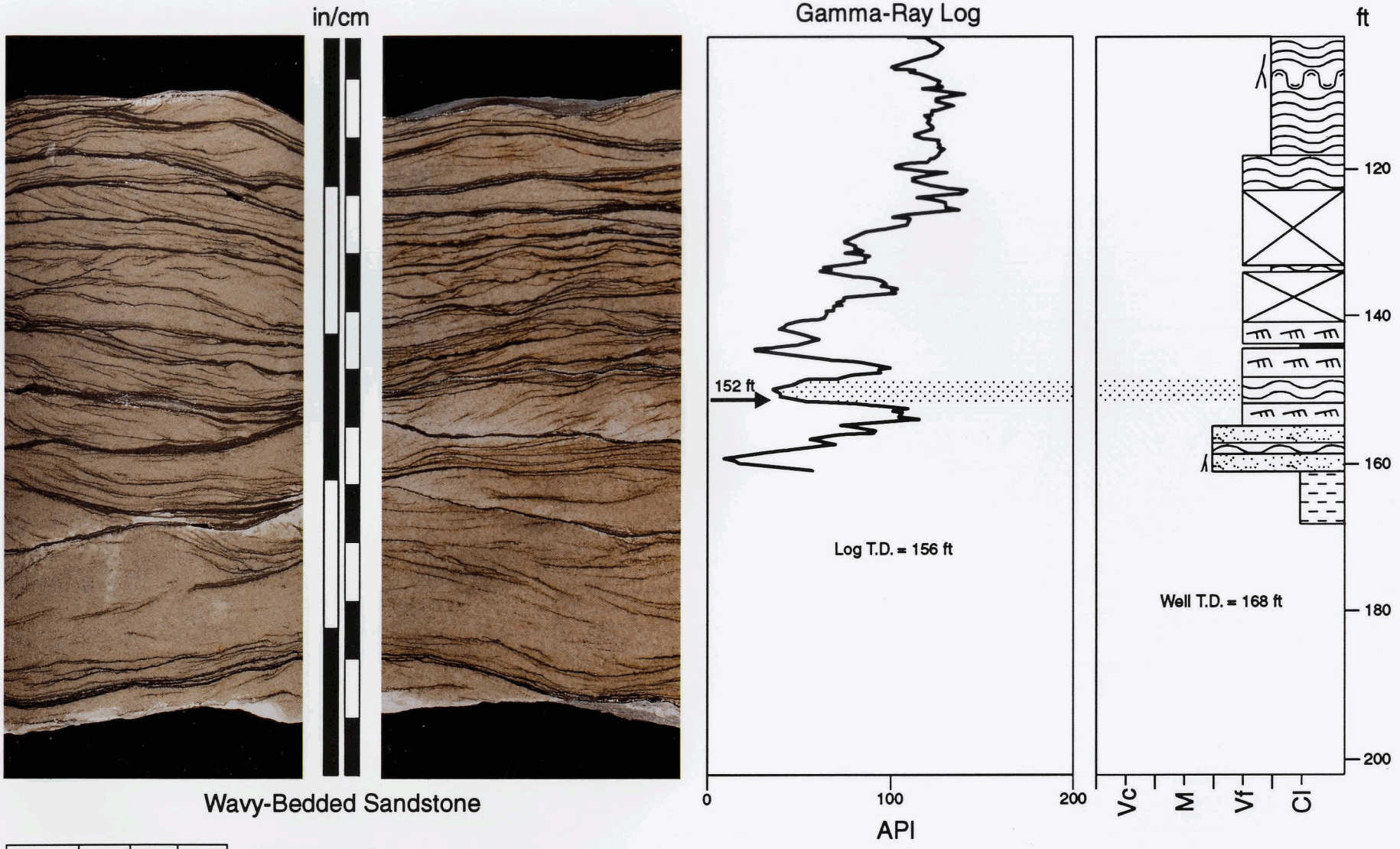
III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The flaser-bedded sandstone facies is associated with other sandstone facies that, together, show a decrease in gamma activity up-section (37 ft to 10 ft). Although the grain size across this interval is predominantly very fine-grained, the gradual decrease in the clay content going from the wavy-bedded sandstone at 32 ft to the massive-bedded sandstone at 15 ft results in a poorly developed funnel-shaped gamma-ray well-log signature.



Map showing area of Pennsylvanian rocks and location of corehole.

NSWC Crane IGS(G)2
Sec. 17 - T5N - R3W
Martin County, Indiana



Wavy-Bedded Sandstone

Ss | w | z | 1 [553.5]

Ss	w	z	1

I. NAME: Wavy-bedded sandstone
Formation: Mansfield

II. DESCRIPTION:

Texture: **Sand** – very fine-grained (0.0625 - 0.125 mm) subangular to subrounded
Clay – (less than 0.0039 mm)

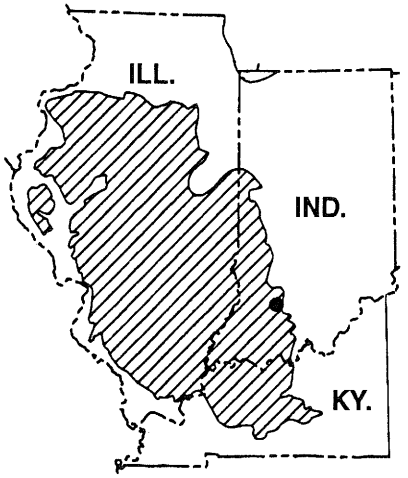
Composition: **Sand** – quartz sand and minor mica with silica and kaolinite cement
Clay – unknown, carbonaceous plant debris common along clay partings

Sedimentary structures and features: Wavy bedding with some minor flaser bedding

Fossils: Some horizontal burrows and carbonaceous plant material

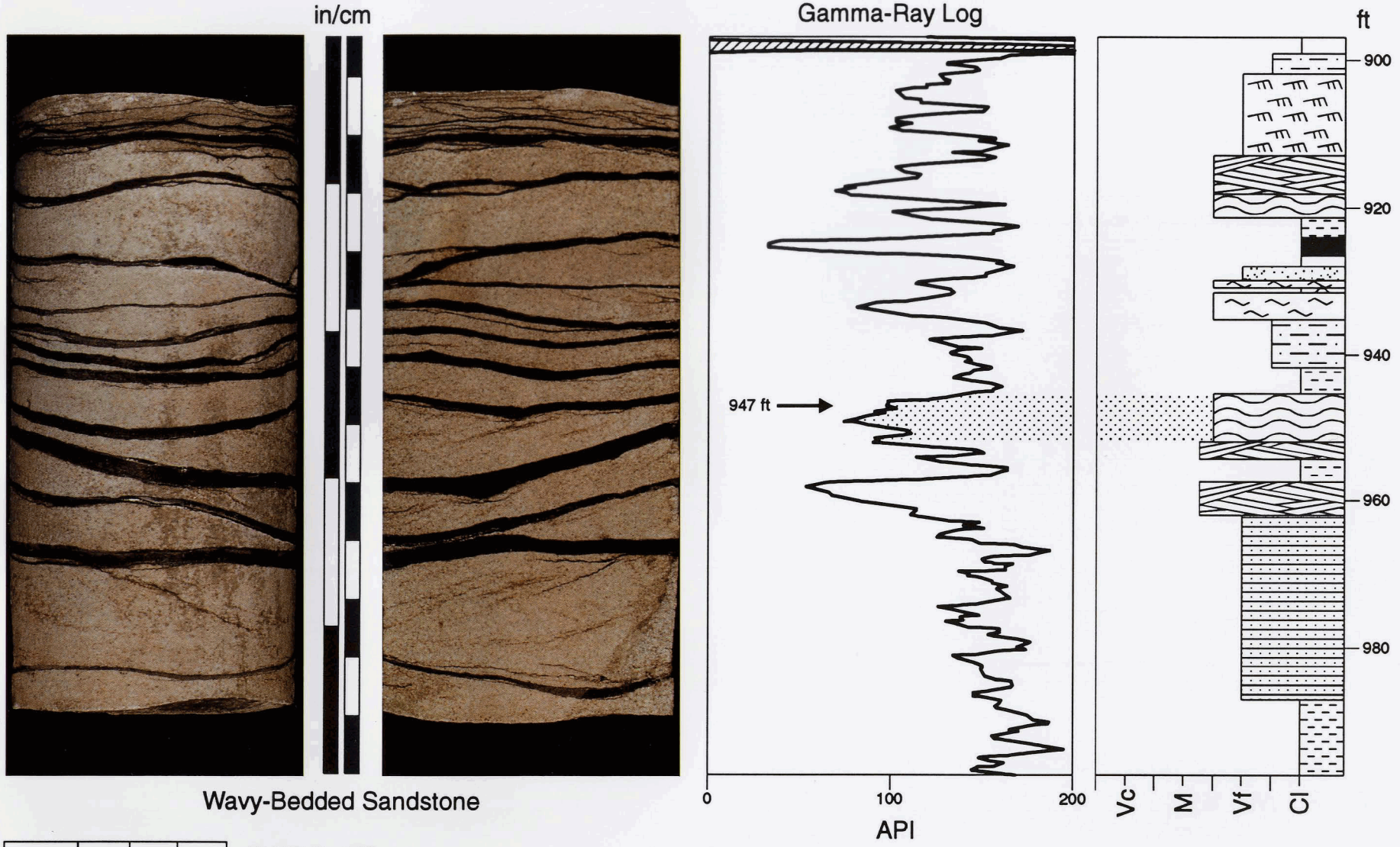
III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The wavy-bedded sandstone forms part of an upward-fining succession that results in a serrated, bell-shaped gamma-ray well-log signature.



Map showing area of Pennsylvanian rocks and location of corehole.

Borehole No. 594
Sec. 19 - M - 21
Webster County, Kentucky



Wavy-Bedded Sandstone

Ss | w | z | 2 [553.5]

Ss	w	z	2

I. NAME: Wavy-bedded sandstone
Formation: Carbondale

II. DESCRIPTION:

Texture: **Sand** – fine-grained (0.125 -0.250 mm) subangular to subrounded
Clay – (less than 0.0039 mm)

Composition: **Sand** – quartz with kaolinite and siderite cement
Clay – unknown

Sedimentary structures and features:
Wavy bedding with clay drapes

Fossils: None observed

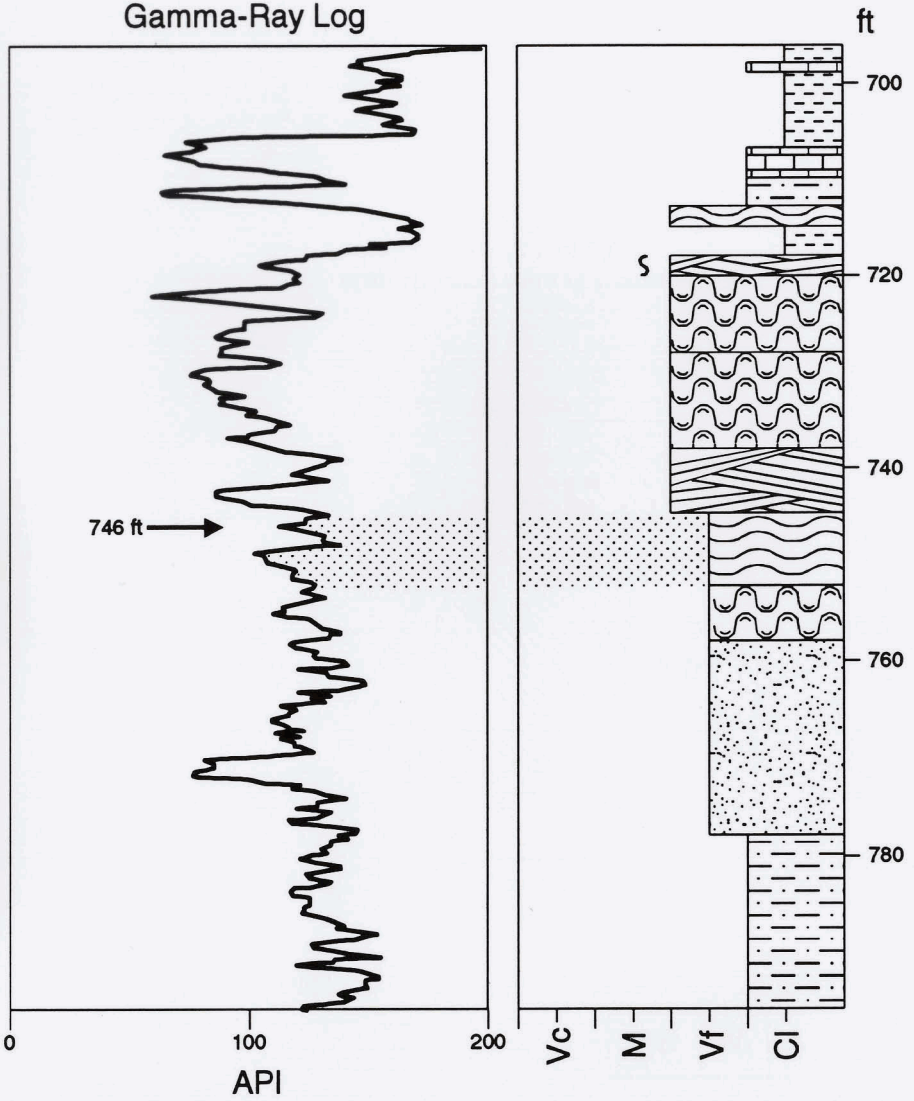
III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The high gamma-ray spike at 898 ft does not correspond to a black shale in the core. Its presence on the log cannot be explained. The upward-coarsening grain-size trend from the base of the columnar profile to 957 ft results in a poorly developed funnel-shaped gamma-ray well-log signature with a serrated character. The thinly bedded, rapidly alternating lithologies from 957 ft to the top of the columnar profile result in an irregular gamma-ray well-log signature across this interval.

Map showing area of Pennsylvanian rocks and location of corehole.

Borehole No. 594
Sec. 19 - M - 21
Webster County, Kentucky

Wavy-Bedded Sandstone



Ss | w | z | 3 [533.5]

Ss	w	z	3

I. NAME: Wavy-bedded sandstone
Formation: Shelburn

II. DESCRIPTION:

Texture: **Sand** – very fine-grained (0.0625 - 0.125 mm) subangular to subrounded
Clay – (less than 0.0039 mm)

Composition: **Sand** – quartz with silica and kaolinite cement
Clay – unknown, abundant mica and carbonaceous plant material along partings

Sedimentary structures and features: Wavy bedding and possible rhythmic bedding

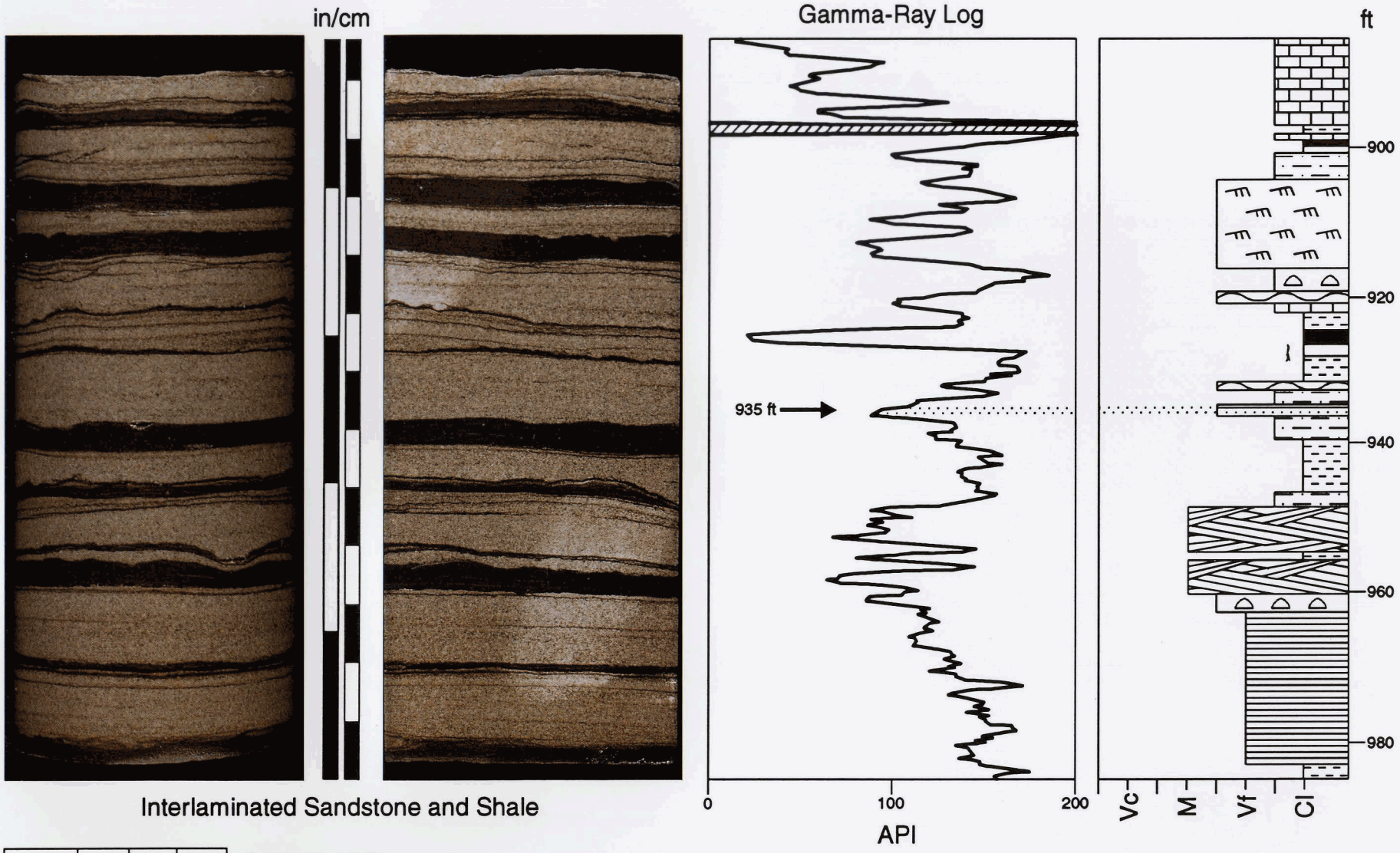
Fossils: Carbonaceous plant material

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The presence of abundant clay throughout this sand-dominated succession results in a gamma-ray curve with a relatively high API count and a serrated character. The gradual upward-coarsening succession from the base of the columnar profile to the wavy-bedded sandstone at 715 ft results in a poorly defined funnel-shaped 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



Interlaminated Sandstone and Shale

Ss	i	z	1	[332.6]

Ss	i	z	1

I. NAME: Interlaminated sandstone and shale
Formation: Carbondale

II. DESCRIPTION:

Texture: **Sand** – fine-grained (0.125 -0.250 mm) subangular to subrounded
Clay – (less than 0.0039 mm)

Composition: **Sand** – quartz with silica and kaolinite cement
Clay – unknown, abundant carbonaceous plant material and mica along clay partings

Sedimentary structures and features: Interlaminated sandstone and shale, minor wavy bedding

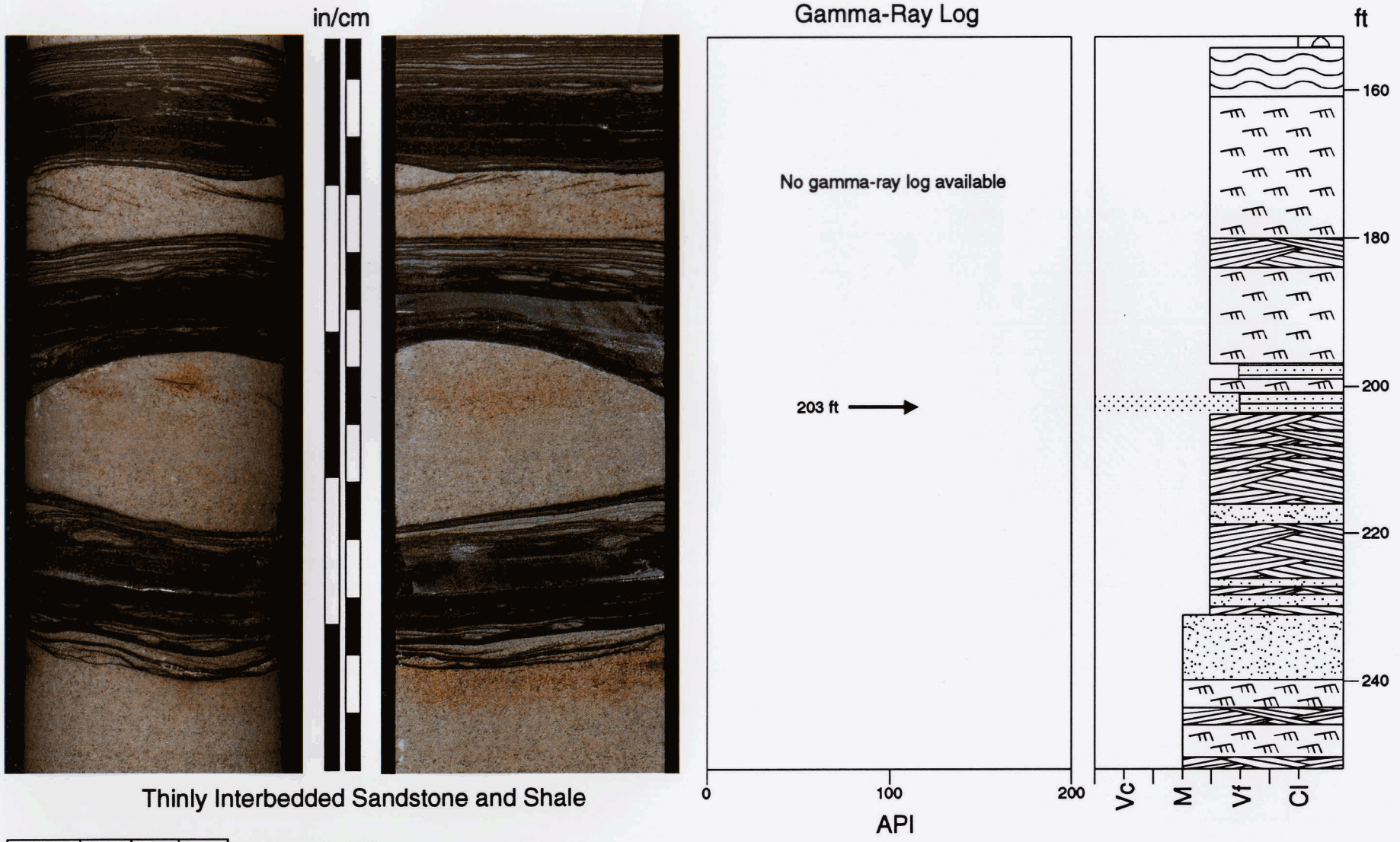
Fossils: Possible horizontal burrows and trackways, carbonaceous plant material

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The high gamma-ray spike at 898 ft is a radioactive black shale. The gamma-ray curve shows a well-developed funnel-shaped signature from the base of the columnar profile to the top of the cross-bedded sandstone (953 ft). The gamma-ray profile from 953 ft to the base of the coal at approximately 925 ft shows an irregular gamma-ray well-log signature.

Map showing area of Pennsylvanian rocks and location of corehole.

Illinois State Geological Survey COGEOMAP S-2
Sec. 29 - T10S - R5E
Saline County, Illinois



Thinly Interbedded Sandstone and Shale

Ss | i | z | 2 [332.5]

Ss	i	z	2

I. NAME: Thinly interbedded sandstone and shale

Formation: Tradewater

II. DESCRIPTION:

Texture: **Sand** – very fine-grained (0.0625 - 0.125 mm) subangular to subrounded

Silt and clay – (less than 0.0625 mm)

Composition: **Sand and silt** – quartz with silica, kaolinite, and siderite cement, very fine-grained coal fragments

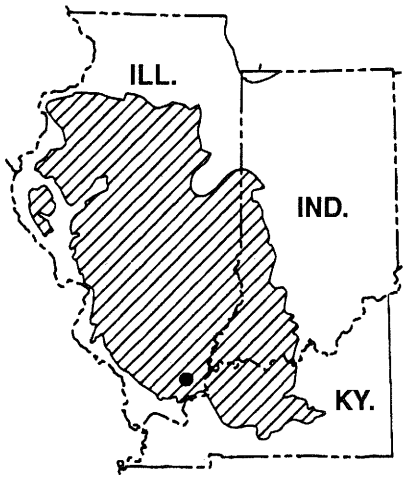
Clay – unknown, mica and finely disseminated plant material abundant along clay partings

Sedimentary structures and features: Interlaminated sandstone and shale, ripple bedding, small-scale disturbed bedding, possible rhythmic bedding

Fossils: Finely disseminated plant material

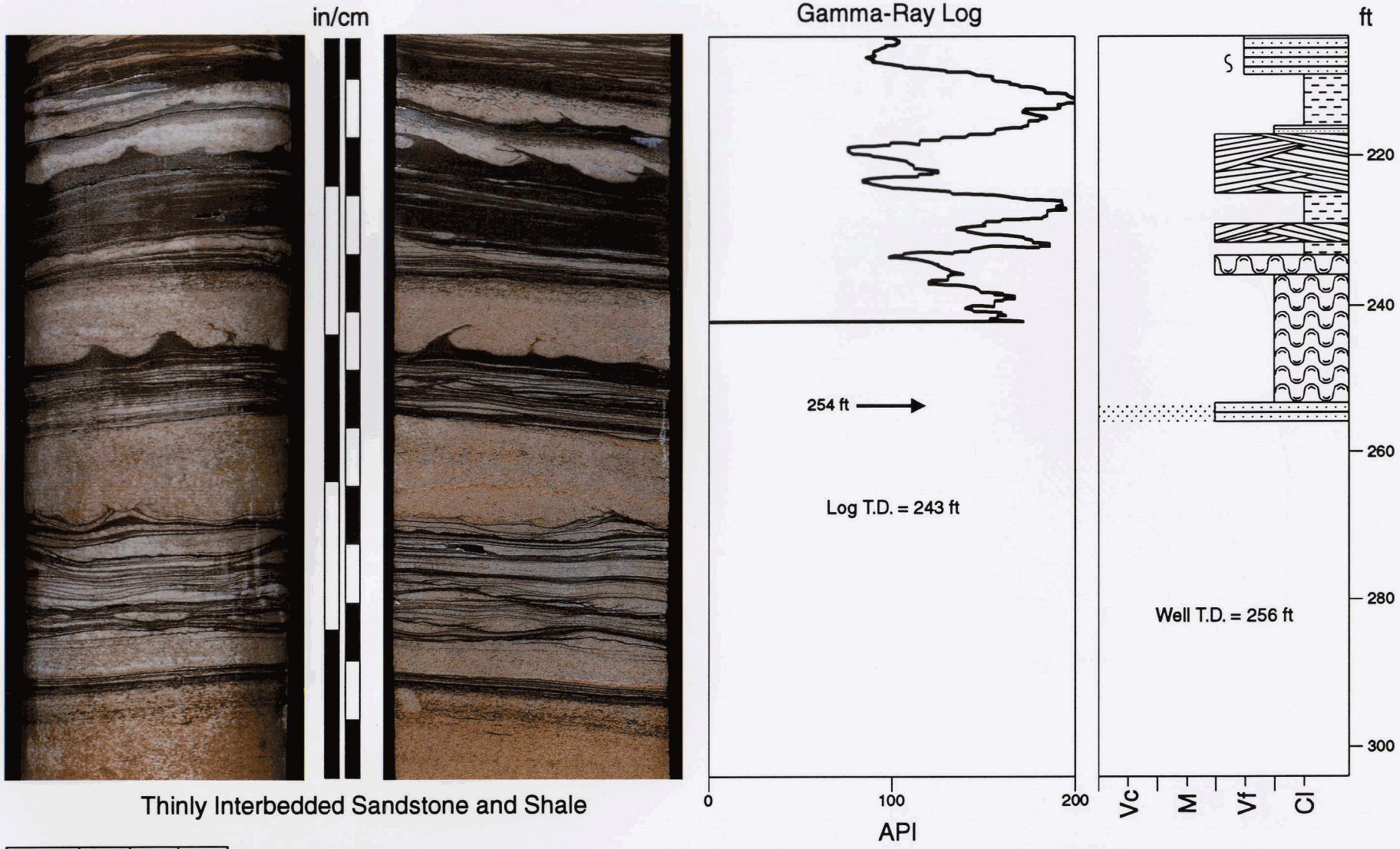
III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

No gamma-ray well-log available.



Map showing area of Pennsylvanian rocks and location of corehole.

Illinois State Geological Survey COGEOMAP C-5
Sec. 36 - T11S - R3E
Johnson County, Illinois



Thinly Interbedded Sandstone and Shale

Ss | i | z | 3 [322.5]

Ss	i	z	3

I. NAME: Thinly interbedded sandstone and shale

Formation: Tradewater

II. DESCRIPTION:

Texture: **Sand** – fine-grained (0.125 - 0.250 mm) subangular to subrounded

Composition: **Sand** – quartz with silica and kaolinite cement

Clay – unknown

Sedimentary structures and features: Minor disturbed bedding (flame structures), wavy bedding, minor lenticular bedding, thinly interbedded to interlaminated sandstone and shale

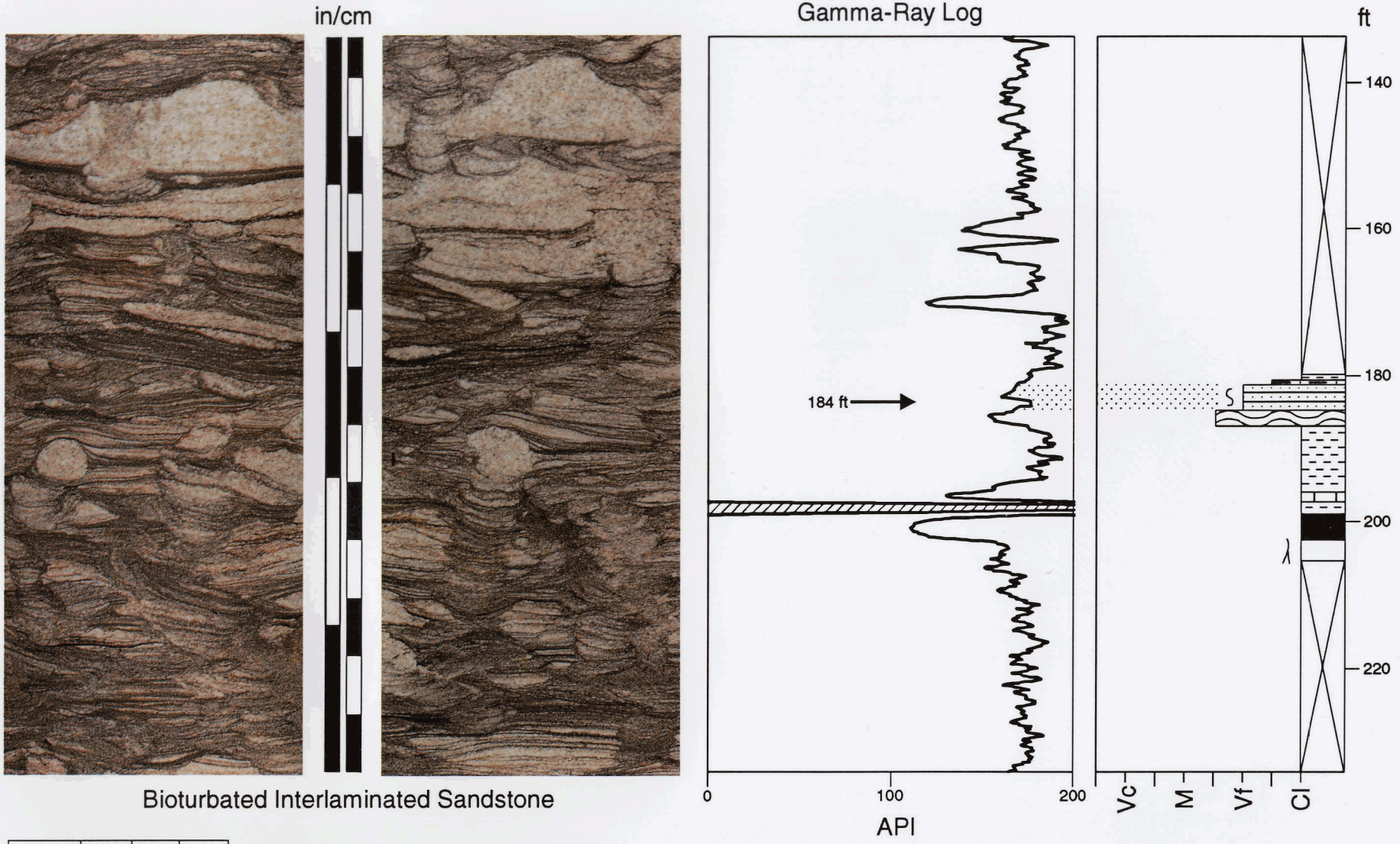
Fossils: None observed

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

The gamma-ray well-log curve does not cover the interval shown by the example in the photograph. However, the gamma-ray profile from 244 ft to the top of the page shows an irregular signature as a result of the abrupt lithologic changes between the sandstone and the shale units.

Map showing area of Pennsylvanian rocks and location of corehole.

Exxon EIBIND-18CH1
Sec. 9 - T5N - R6W
Knox County, Indiana



Bioturbated Interlaminated Sandstone

Ss | i | b | 1 [548]

Ss	i	b	1

I. NAME: Bioturbated interlaminated sandstone
Formation: Dugger

II. DESCRIPTION:

Texture: **Sand** – very fine-grained (0.0625 - 0.125 mm) subangular to subrounded

Composition: **Sand** – quartz with silica, kaolinite, and siderite cement, carbonaceous material common, slightly calcareous

Sedimentary structures and features: Bioturbation

Fossils: Trace fossil *Monocraterion*, possible escape burrows

III. GAMMA-RAY WELL-LOG CHARACTERISTICS:

Only a small portion of the stratigraphic interval shown by the gamma-ray curve has core available for examination. However, the gamma-ray curve across the entire succession is reading at or near the shale baseline indicating a shale-dominated succession. The high gamma-ray spike at 197 ft is a radioactive black shale. The gamma-ray signature shows no consistent upward-fining or upward-coarsening trend but shows an irregular signature.

Map showing area of Pennsylvanian rocks and location of corehole.