Public-data File 89-1c

STRUCTURAL EVOLUTION OF THE CENTRAL SHUBLIK MOUNTAINS AND IGNEK VALLEY, NORTHEASTERN BROOKS RANGE, ALASKA

By

J.A. Rogers[1]

Alaska Division of
Geological and Geophysical Surveys

February 1989

794 University Avenue, Suite 200
Fairbanks, Alaska 99709-3645

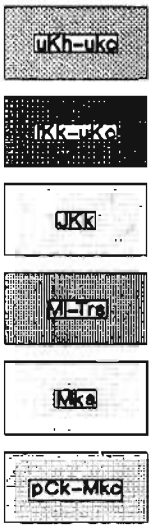
[1]University of Alaska Fairbanks, Fairbanks, Alaska 99775.

ABSTRACT

The Shublik Mountains are an east-west trending, asymmetric anticlinorium which formed above a ramp that branches from a decollement in a pre-Mississippian basement. During deformation and as the amount of displacement across the decollement increased, a number of structures formed.

Evolution of the central Shublik Mountains and Ignek Valley began when the decollement and ramp, originally formed during pre-Mississippian deformation, were reactivated during Mesozoic and Cenozoic deformation. Above these faults a variety of structures, bounded by decollements within the relatively weakest stratigraphic units, formed simultaneously. Mississippian and older rocks, between the ramp and a decollement in the Mississippian Kayak Shale, were displaced northward as a single horse in a regional scale duplex. Detachment folds formed in Mississippian through Triassic rocks above the Kayak Shale. Folding and minor duplexing of the lower Cretaceous Kemik Sandstone occurred above a decollement in the Jurassic to Cretaceous Kingak Shale. In addition, a thrust sheet of the upper Cretaceous Canning Formation was displaced northward above a decollement in the upper Cretaceous Hue Shale. All of these structures, except the duplex of the Kemik Sandstone, were later involved in the formation of a fault-propagation fold and then cut by two high-angle reverse faults that caused the great structural relief along the mountain front. Each structure migrated eastward from its point of origin to the west.

Explanation of Map Units



Canning Formation and Hue Shale

Canning Formation, Hue Shale, Pebble Shale, and Kemik Sandstone

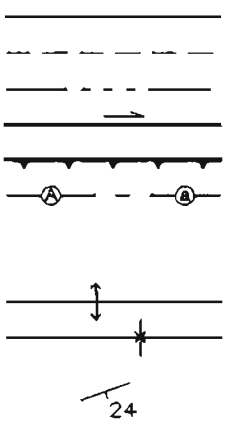
Kingak Shale

Shublik Formation, Sadlerochit Group, and Lisburne Group

Kayak Shale

Kekiktuk Conglomerate, Nanook Limestone, and Katakturuk Dolomite

Geologic Cross Section and Map Symbols



Contact

Trace of bedding

Pre-Mississippian unconformity

Thrust Fault in cross section---Showing sense of displacement

Thrust Fault in map view---Saw teeth on hanging wall

Axial surface of folds in cross section
Labeled when formed by structures detailed in sections
Upper case labels indicate axis formed above pre-Miss. unc.
Lower case labels indicate axis formed below pre-Miss. unc.

Axis of anticline---Showing direction of dip of limbs and plunge of axis

Axis of syncline---Showing direction of dip of limbs and plunge of axis

Strike and dip of inclined beds

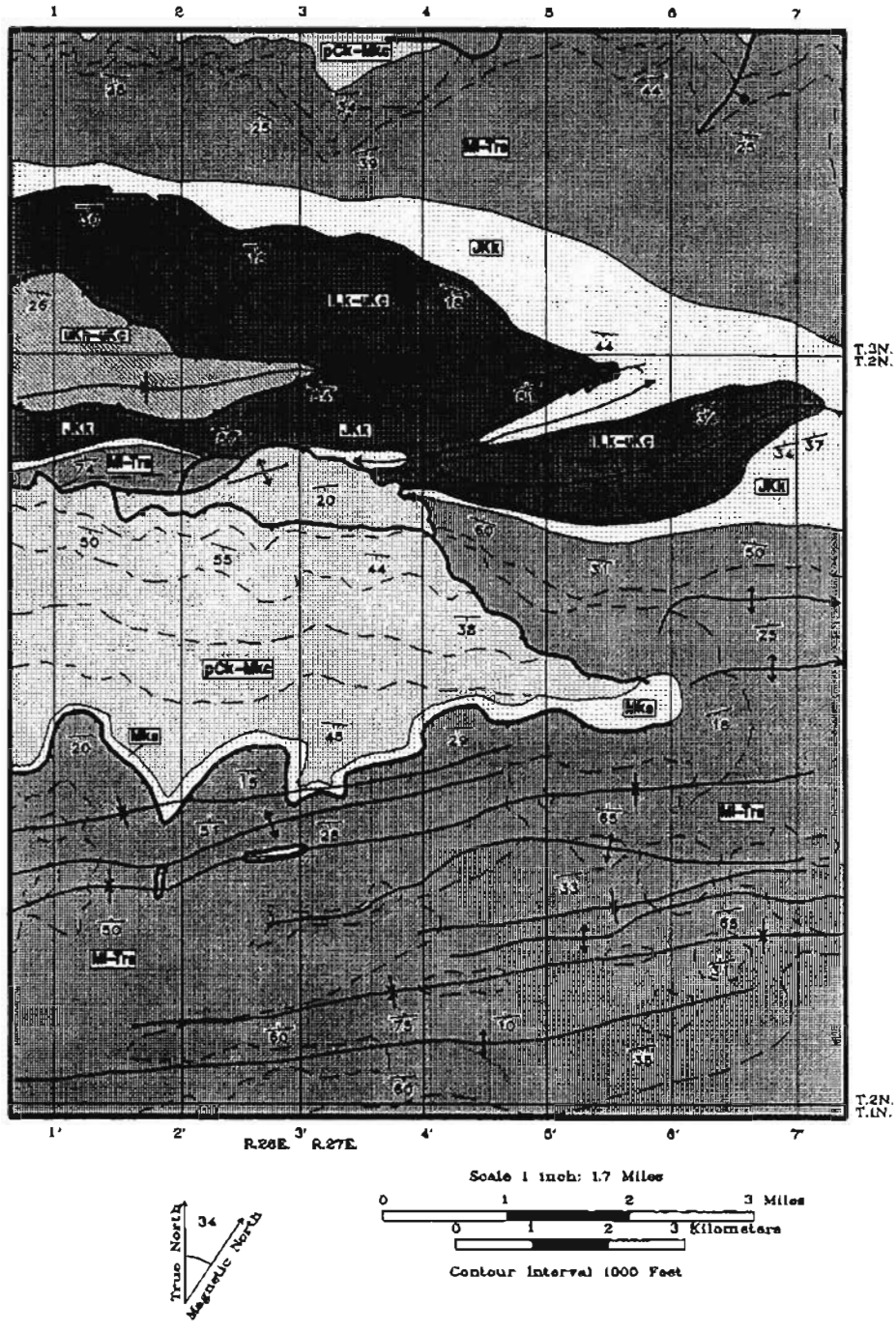
References

Robinson, M.S., Decker, John, Clough, J.G., Reifenstuhl, R.R., Bakke, Arne, Smith, T.E., Smith, G.H., Rogers, J.A., Imm, T.A., and Meigs, A.J., 1987, Bedrock geology of the Mt. Michelson C-3 quadrangle, Alaska: Ak. Div of Geological and Geophysical Surveys Public Data File 87-27b, scale 1:63,360, 1 sheet, 14 p.

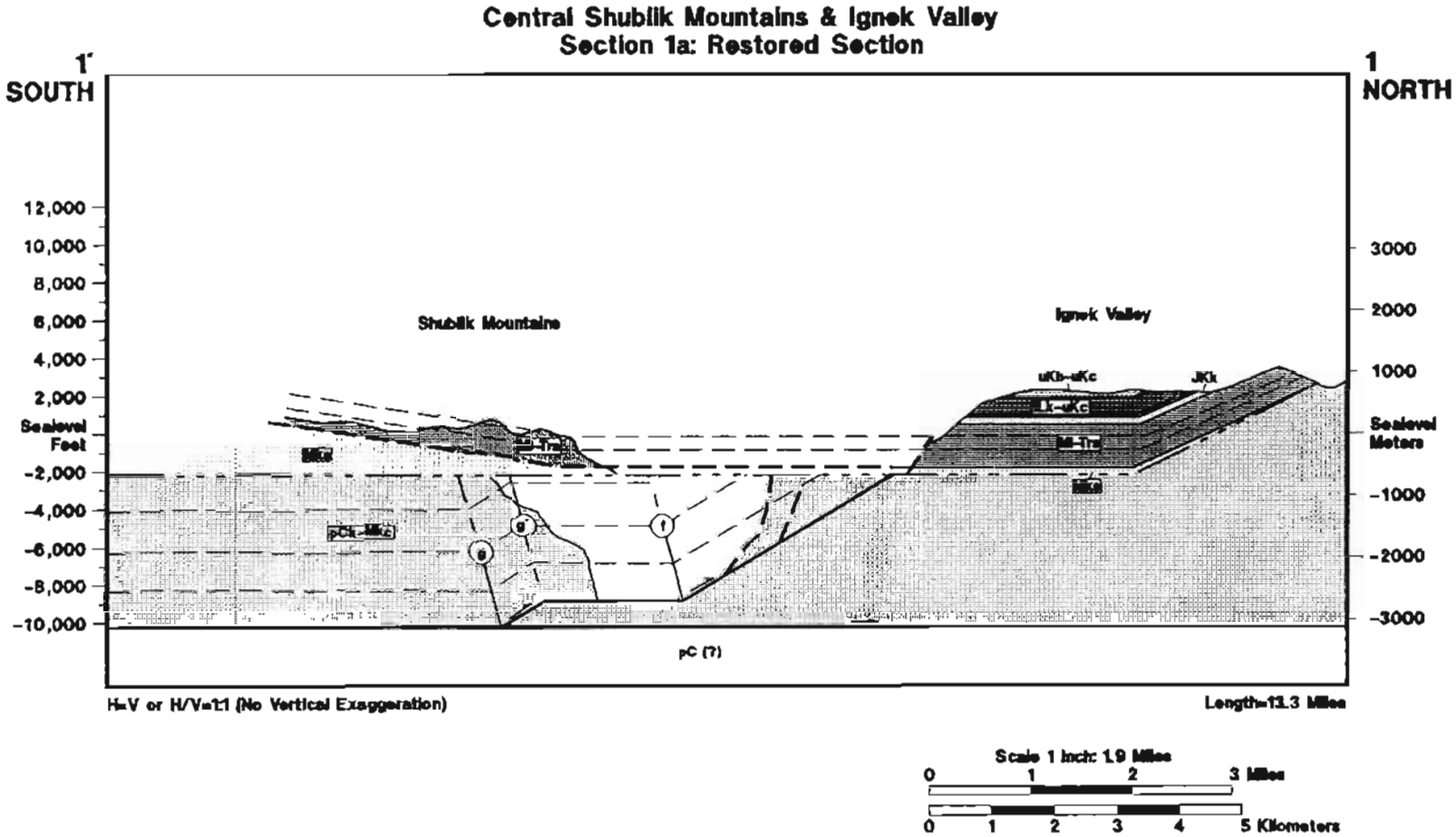
Robinson, M.S., Bakke, Arne, Bundtzen, T.K., Laird, G.M., Decker, John, Clough, J.G., Reifenstuhl, R.R., Imm, T.A., and Meigs, A.J., 1987, Bedrock geology of the Mt. Michelson B-3 quadrangle, Alaska: Ak: Div of Geological and Geophysical Surveys Public Data File 87-27f, scale 1:63,360, 1 sheet, 7 p.

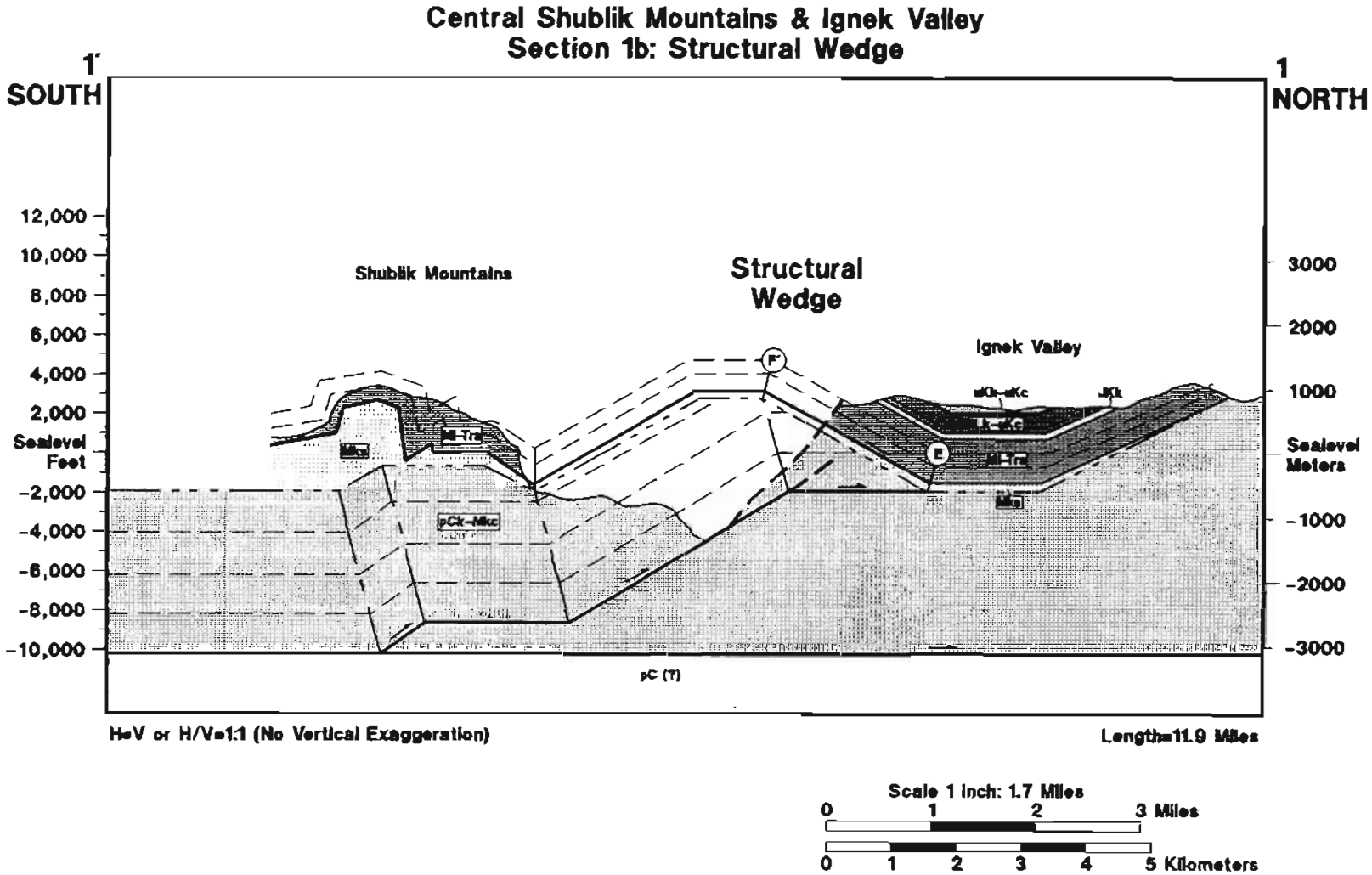
Rogers, J.A., 1986, Preliminary bedrock geologic map of the northern central Shublik Mountains and Ignek Valley, Northeastern Alaska: Ak. Div of Geological and Geophysical Surveys Public Data File 86-86a, scale 1:25,000, 1 sheet, 12 p.

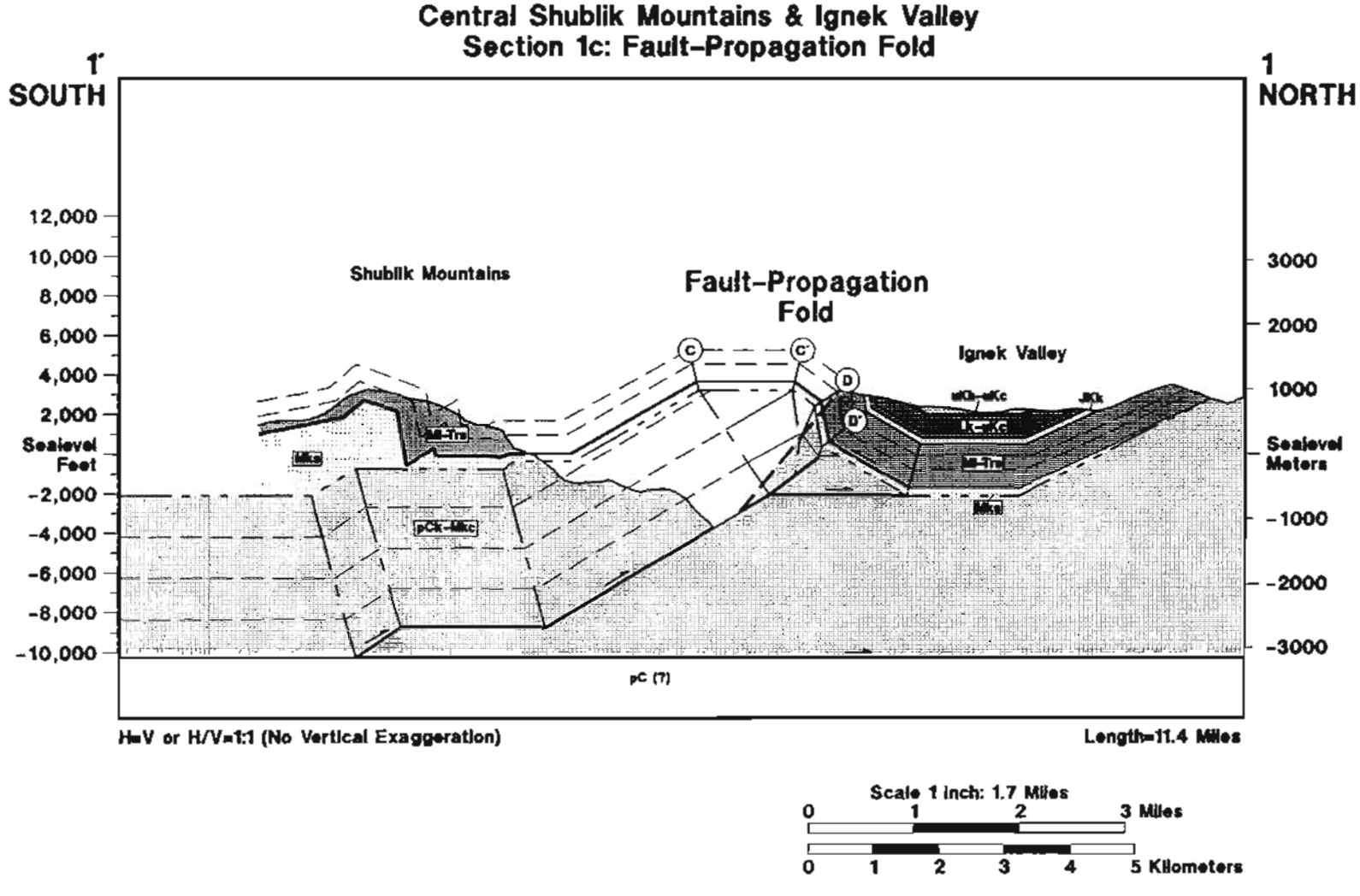
Simplified Geologic Map of the Central Shublik Mountains and Ignek Valley, Northeastern Brooks Range, Alaska

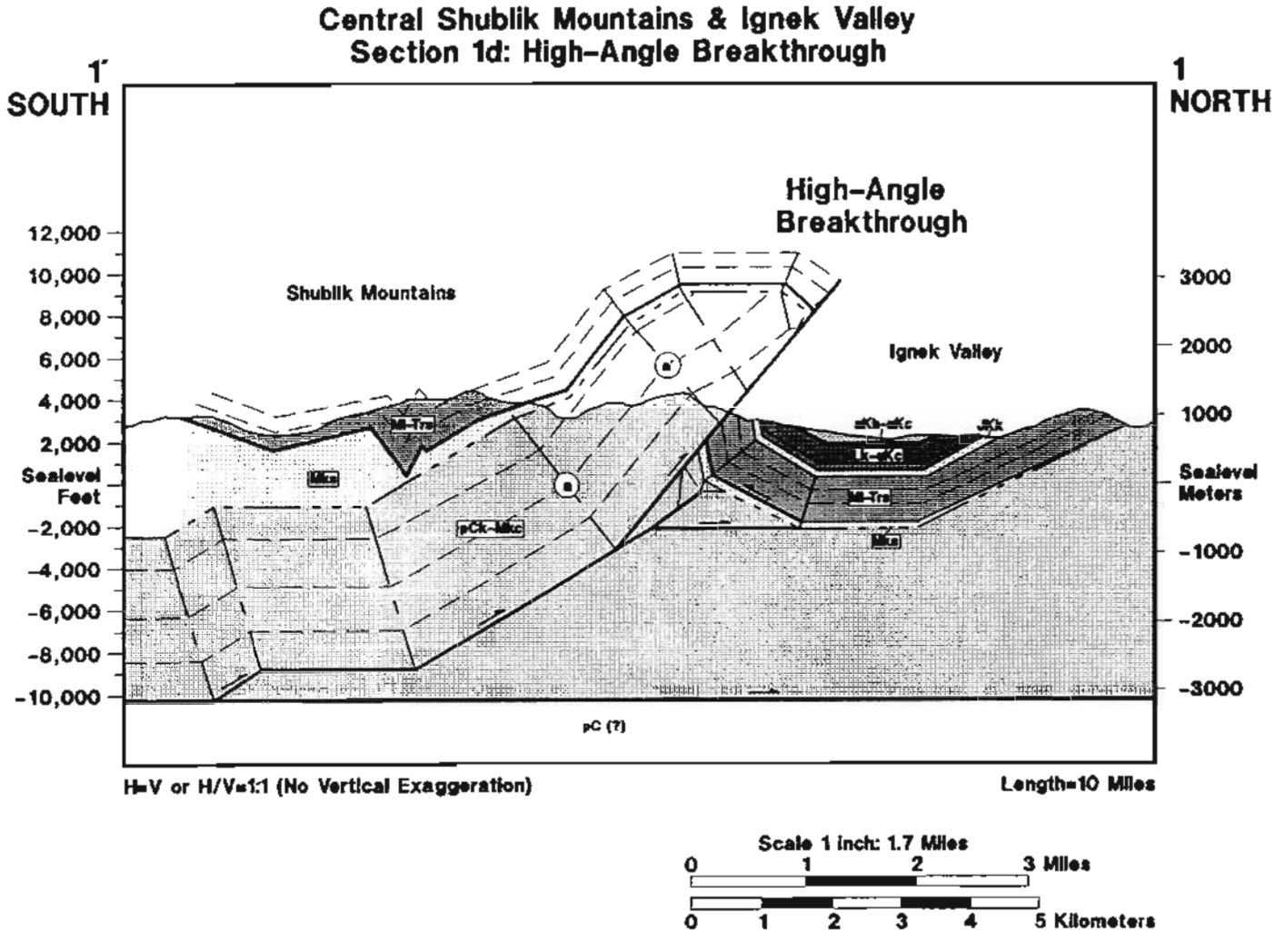


Mapping by Robinson and others, 1987 a&b, and Rogers J.A., 1986

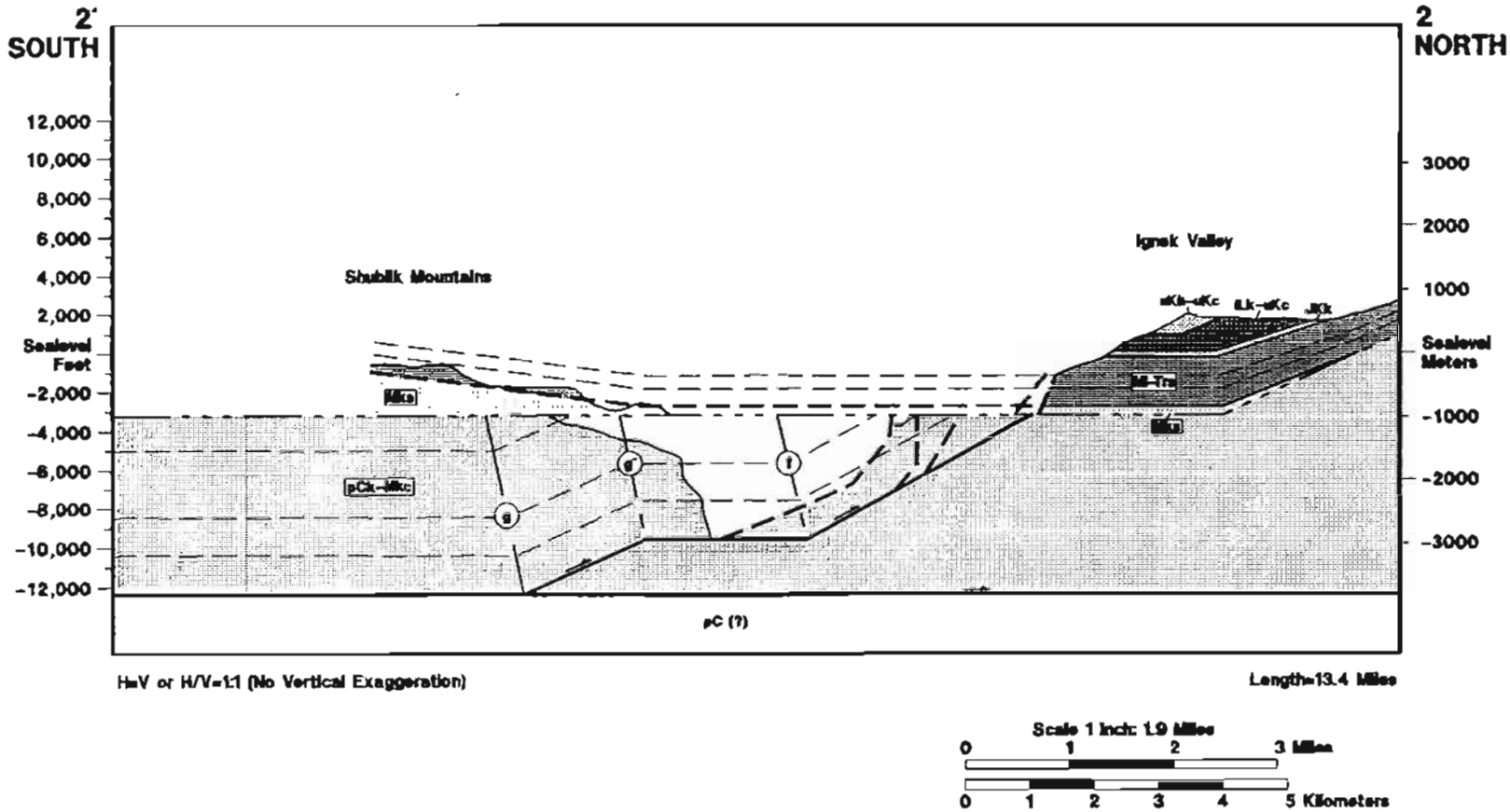

Central Shublik Mountains & Ignek Valley
Section 1a: Restored Section
1'
SOUTH
1
NORTH
12,000
10,000
8,000
6,000
4,000
2,000
Sealevel
Feet
-2,000
-4,000
-6,000
-8,000
-10,000
3000
2000
1000
Sealevel
Meters
-1000
-2000
-3000
Shublik Mountains
Ignek Valley
uKb-uKc
JKk
pC (?)
H=V or H/V=1:1 (No Vertical Exaggeration)
Length=13.3 Miles
Scale 1 Inch: 1.9 Miles
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers


Central Shublik Mountains & Ignek Valley
Section 1b: Structural Wedge
1'
SOUTH
1
NORTH
12,000
10,000
8,000
6,000
4,000
2,000
Sealevel
Feet
-2,000
-4,000
-6,000
-8,000
-10,000
3000
2000
1000
Sealevel
Meters
-1000
-2000
-3000
Shublik Mountains
Structural
Wedge
Ignek Valley
pC (T)
H=V or H/V=1:1 (No Vertical Exaggeration)
Length=11.9 Miles
Scale 1 inch: 1.7 Miles
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers

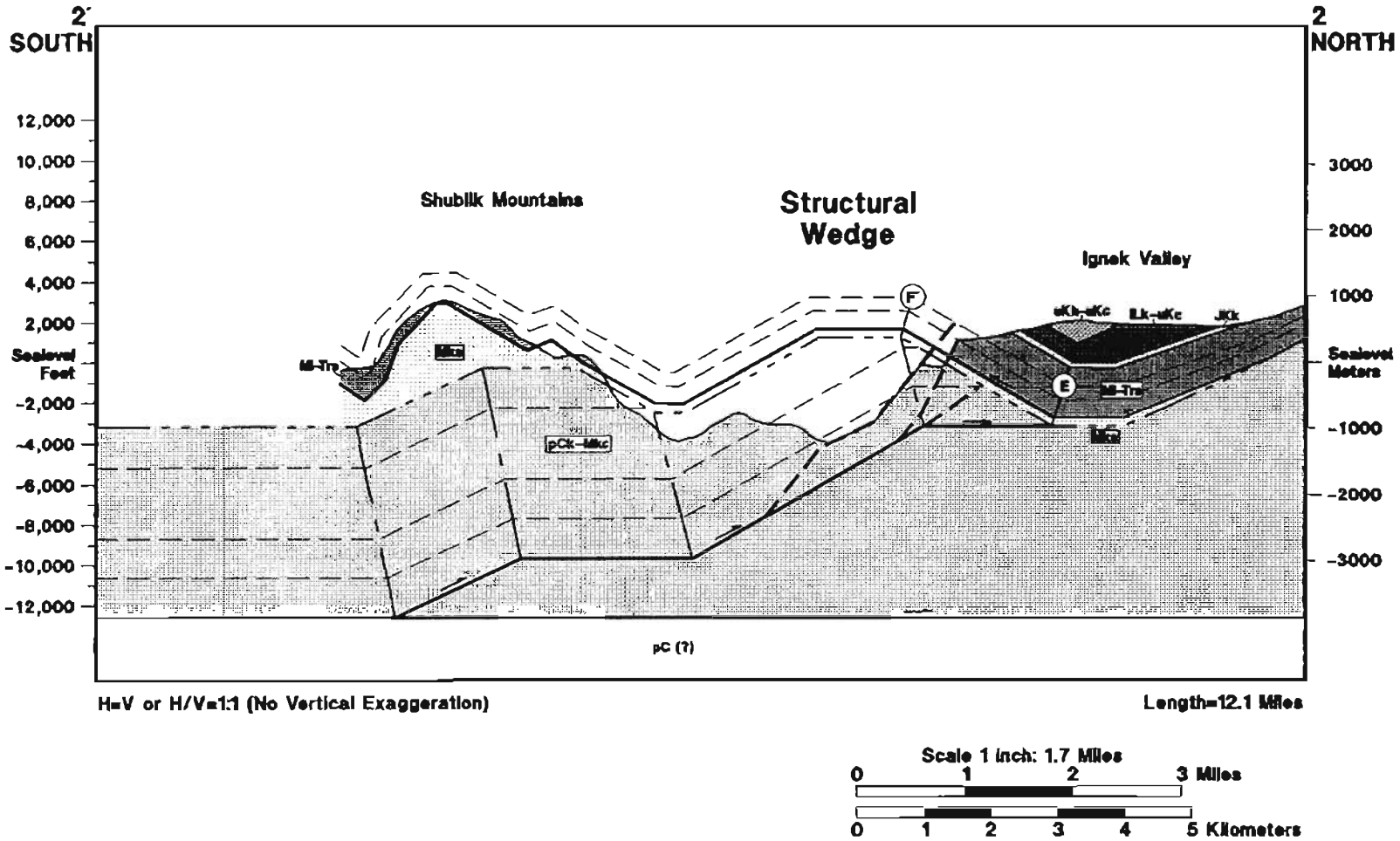

Central Shublik Mountains & Ignek Valley
Section 1c: Fault-Propagation Fold
1'
SOUTH
1
NORTH
12,000
10,000
8,000
6,000
4,000
2,000
Sealevel Feet
-2,000
-4,000
-6,000
-8,000
-10,000
3000
2000
1000
Sealevel Meters
-1000
-2000
-3000
Shublik Mountains
Fault-Propagation Fold
Ignek Valley
C
C'
D
D'
pC (?)
H=V or H/V=1:1 (No Vertical Exaggeration)
Length=11.4 Miles
Scale 1 inch: 1.7 Miles
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers


Central Shublik Mountains & Ignek Valley
Section 1d: High-Angle Breakthrough
1'
SOUTH
1
NORTH
High-Angle
Breakthrough
Shublik Mountains
Ignek Valley
12,000
10,000
8,000
6,000
4,000
2,000
Sealevel
Feet
-2,000
-4,000
-6,000
-8,000
-10,000
3000
2000
1000
Sealevel
Meters
-1000
-2000
-3000
pC (?)
H=V or H/V=1:1 (No Vertical Exaggeration)
Length=10 Miles
Scale 1 inch: 1.7 Miles
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers

Central Shublik Mountains & Ignek Valley
Section 2a: Restored Section



Central Shublik Mountains & Ignek Valley
Section 2b: Structural Wedge



H=V or H/V=1:1 (No Vertical Exaggeration)

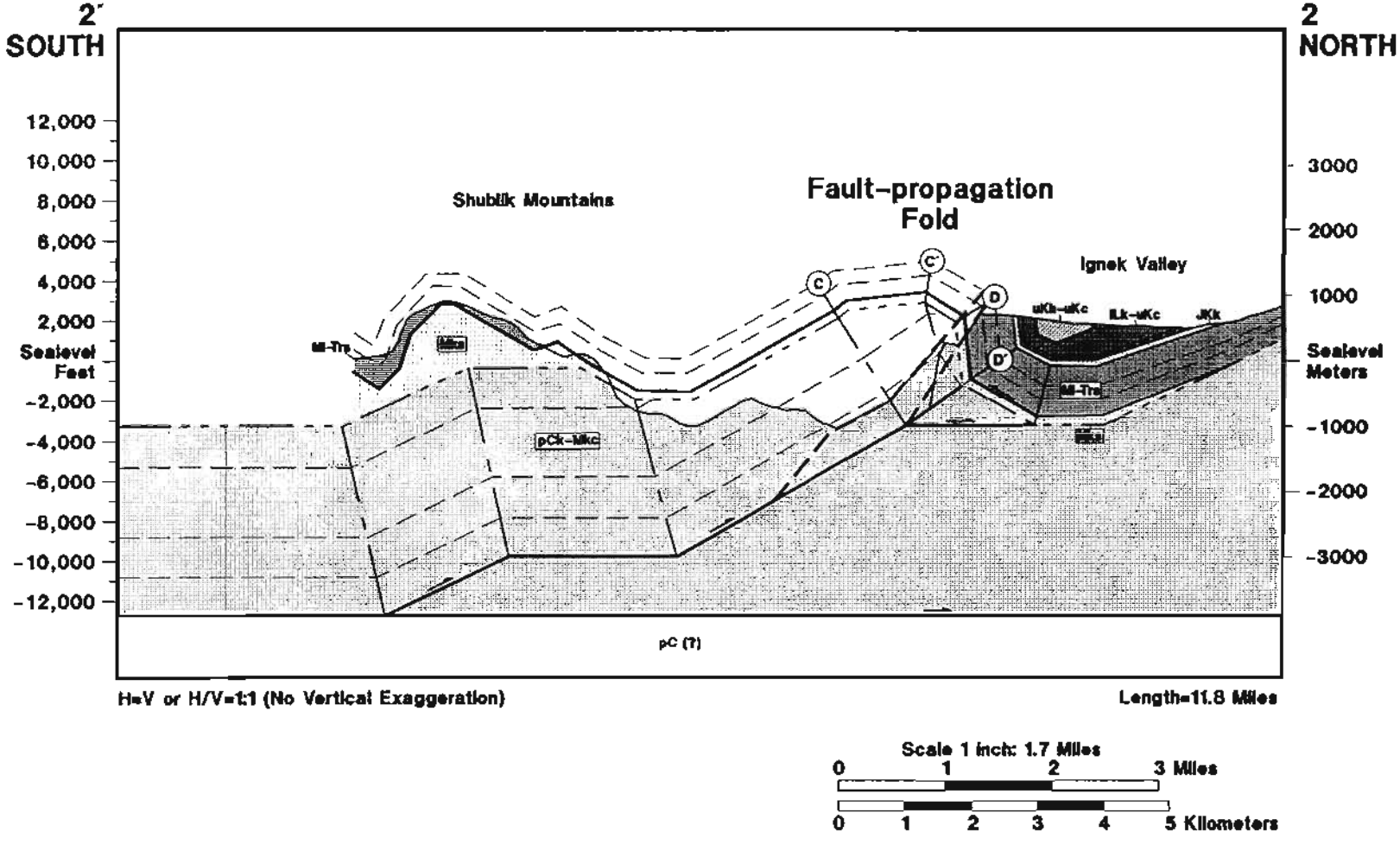
Length=12.1 Miles

Scale 1 inch: 1.7 Miles

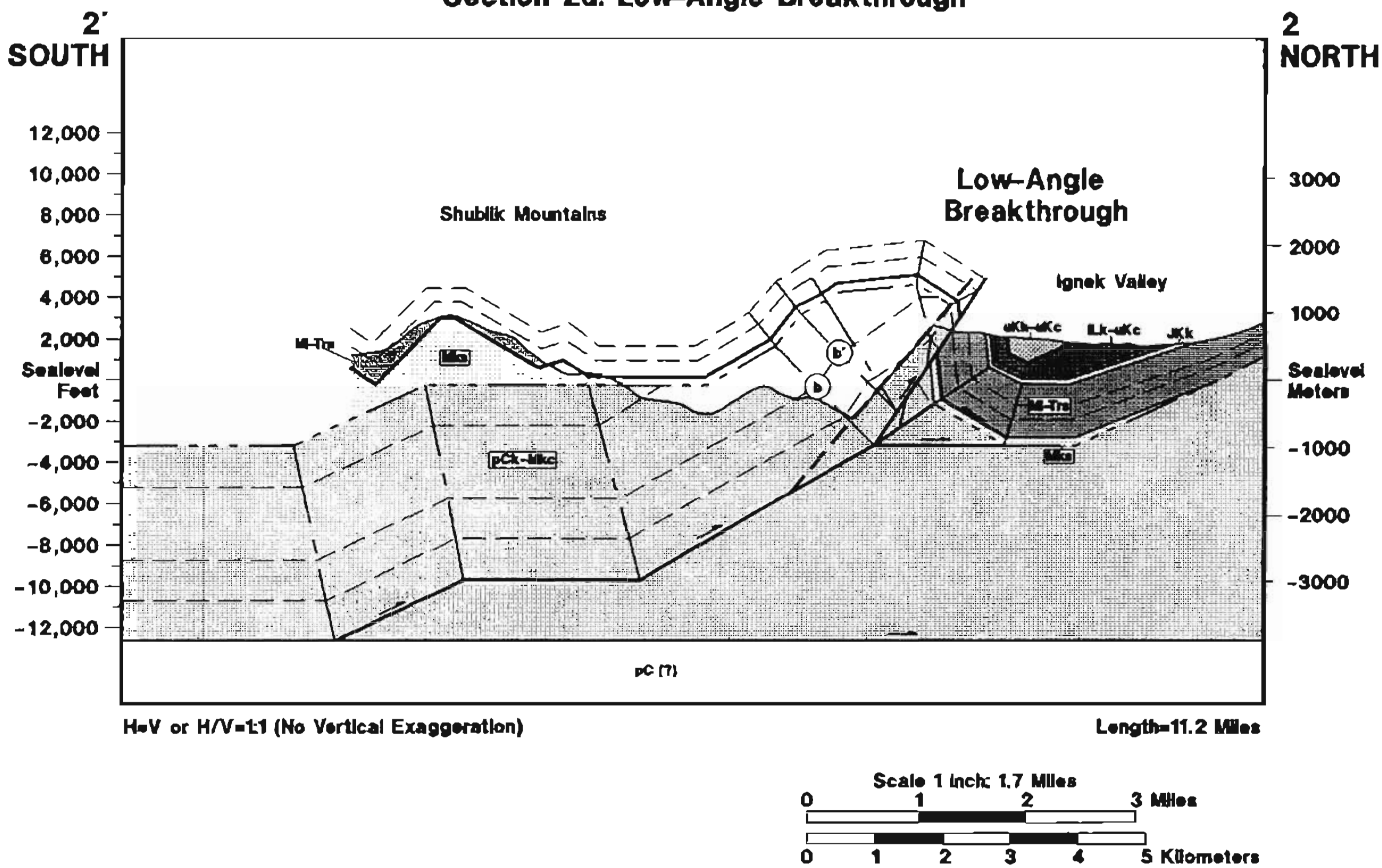
0 1 2 3 Miles

0 1 2 3 4 5 Kilometers

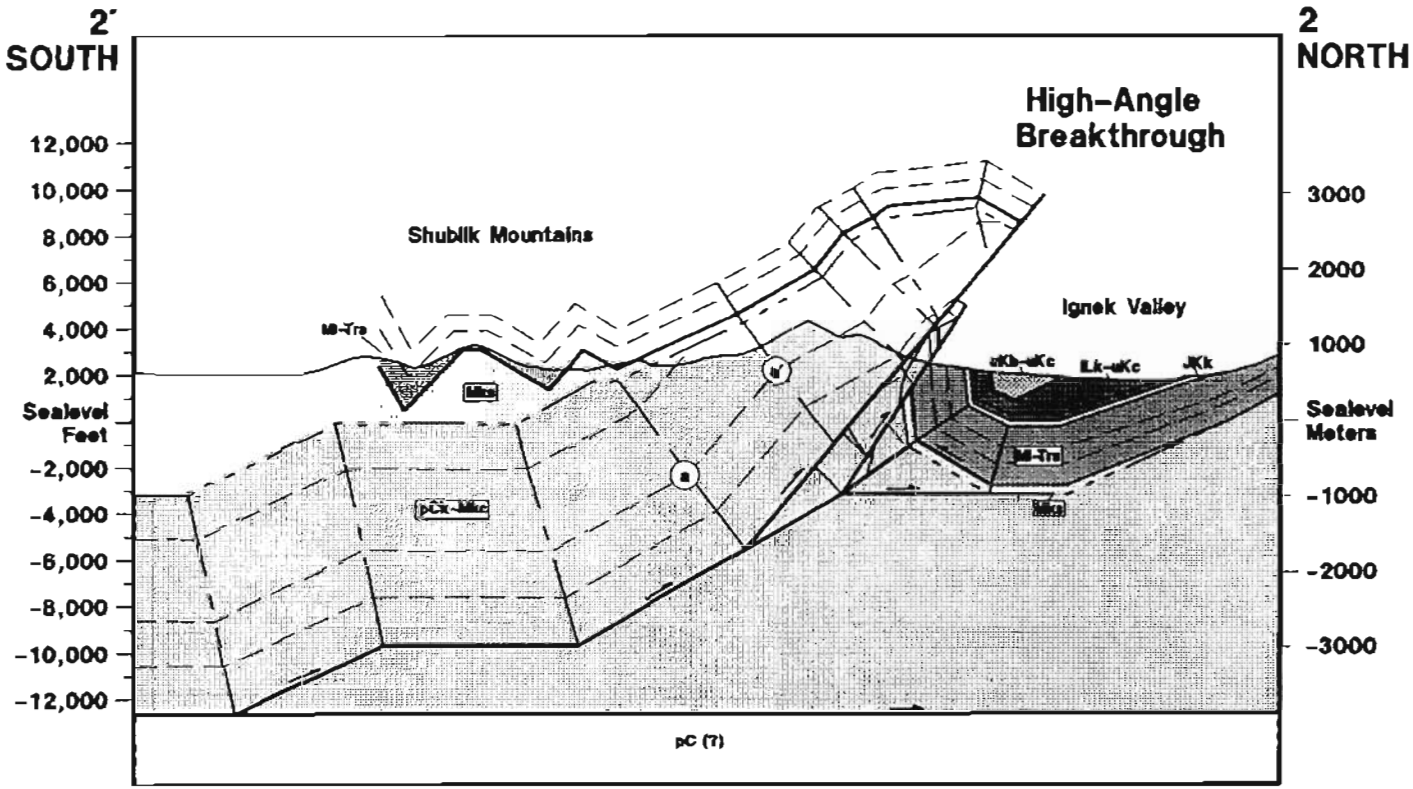
Central Shublik Mountains & Ignek Valley
Section 2c: Fault–Propagation Fold

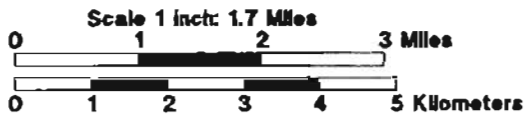


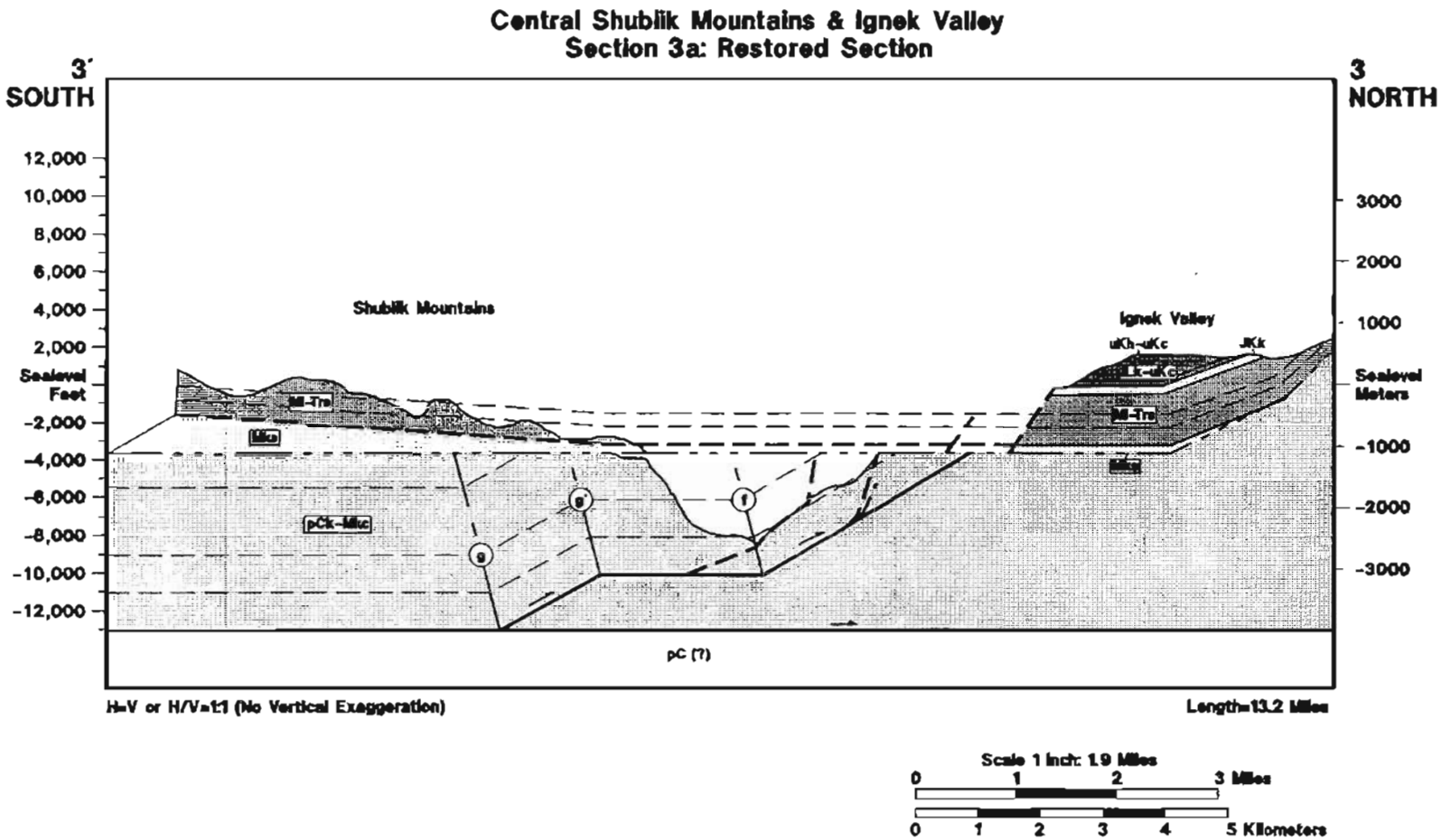
Central Shublik Mountains & Ignek Valley
Section 2d: Low-Angle Breakthrough



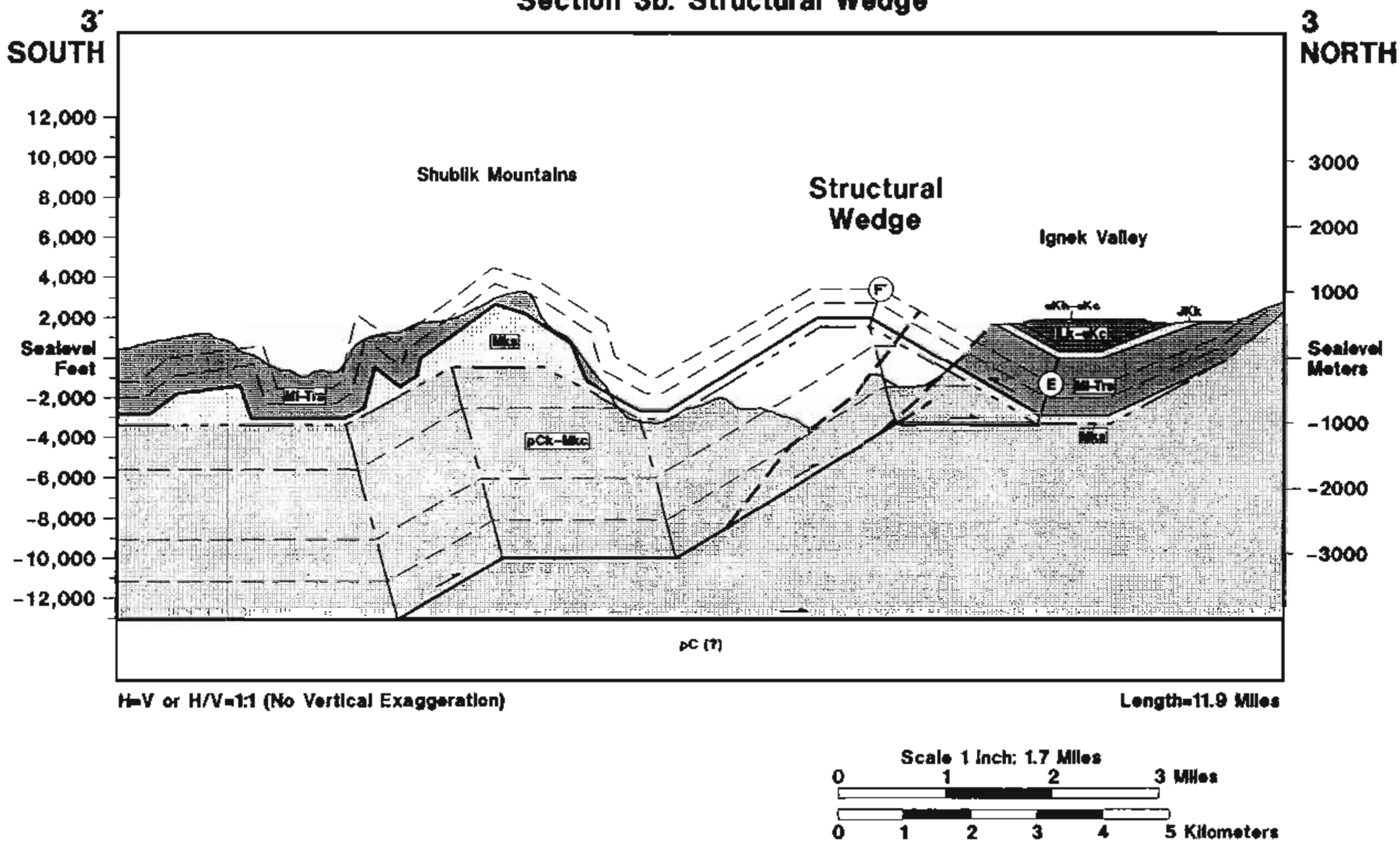
Central Shublik Mountains & Ignek Valley
Section 2e: High-Angle Breakthrough

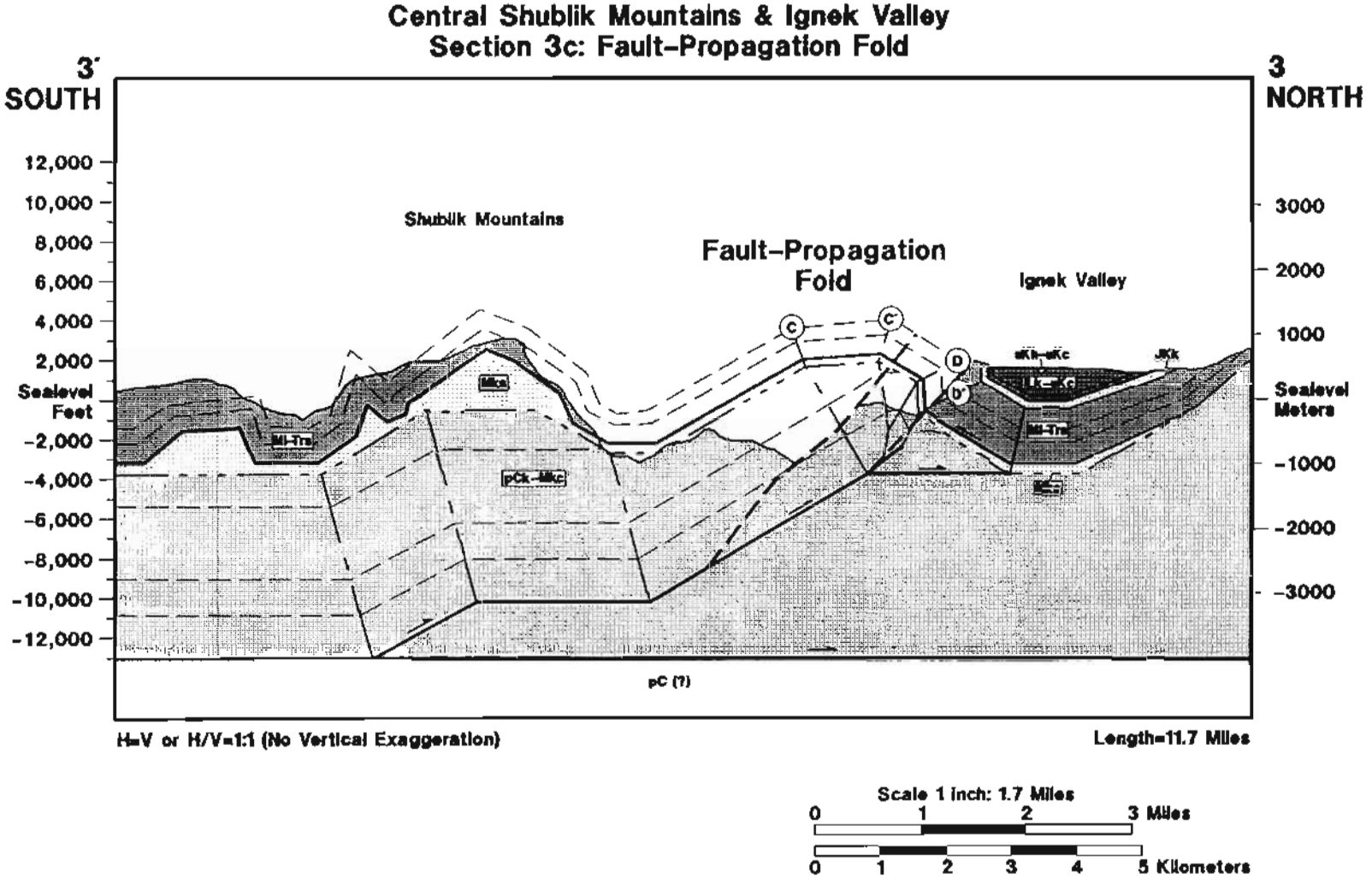




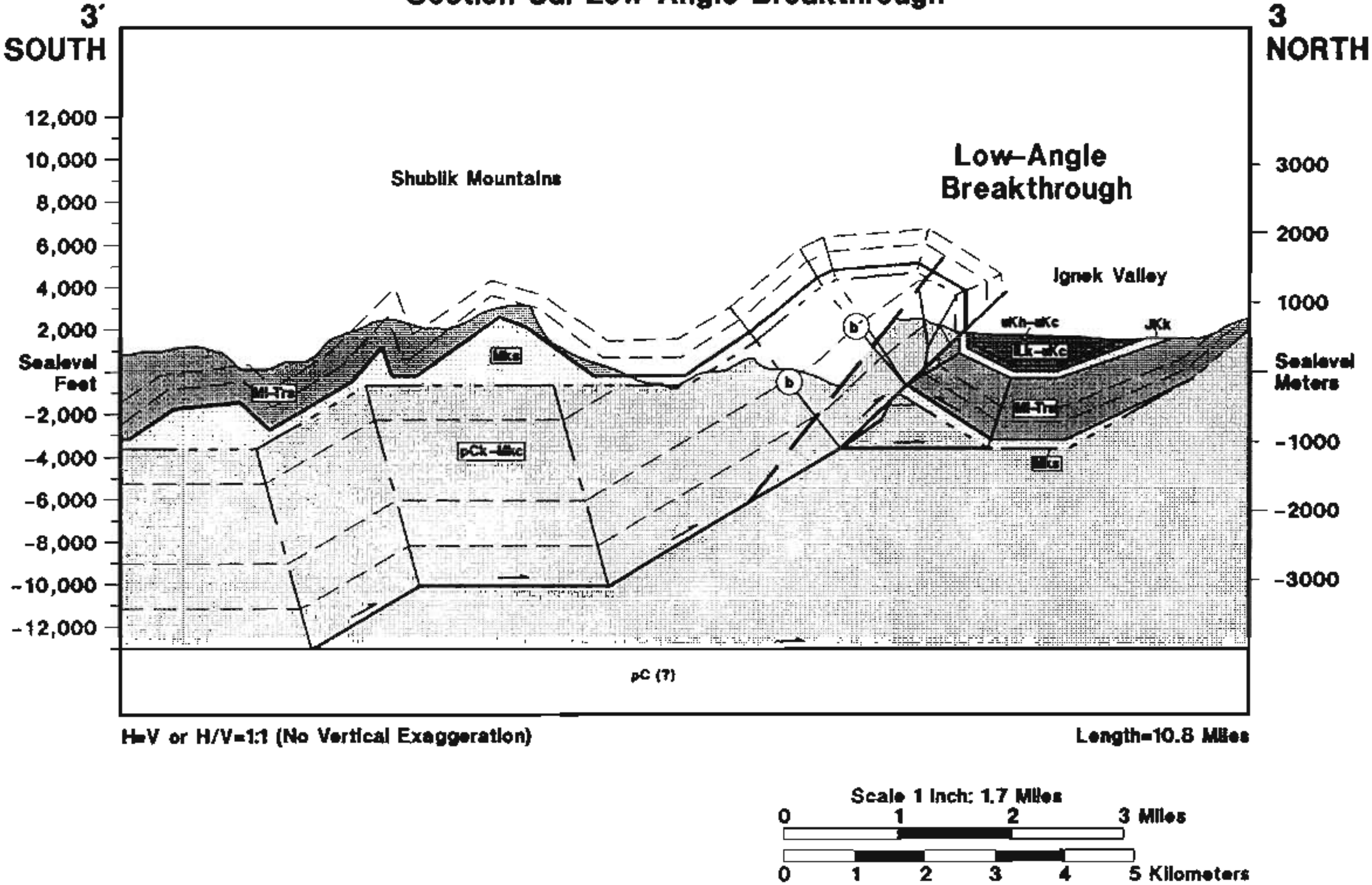

Central Shublik Mountains & Ignek Valley
Section 3a: Restored Section
3'
SOUTH
3
NORTH
12,000
10,000
8,000
6,000
4,000
2,000
Sealevel
Feet
-2,000
-4,000
-6,000
-8,000
-10,000
-12,000
3000
2000
1000
Sealevel
Meters
-1000
-2000
-3000
Shublik Mountains
Ignek Valley
uKh-uKc
JKk
Mi-Tm
Mkp
pCk-Mkc
pC (?)
H=V or H/V=1:1 (No Vertical Exaggeration)
Length=13.2 Miles
Scale 1 inch: 1.9 Miles
0
1
2
3 Miles
0
1
2
3
4
5 Kilometers

Central Shublik Mountains & Ignek Valley
Section 3b: Structural Wedge

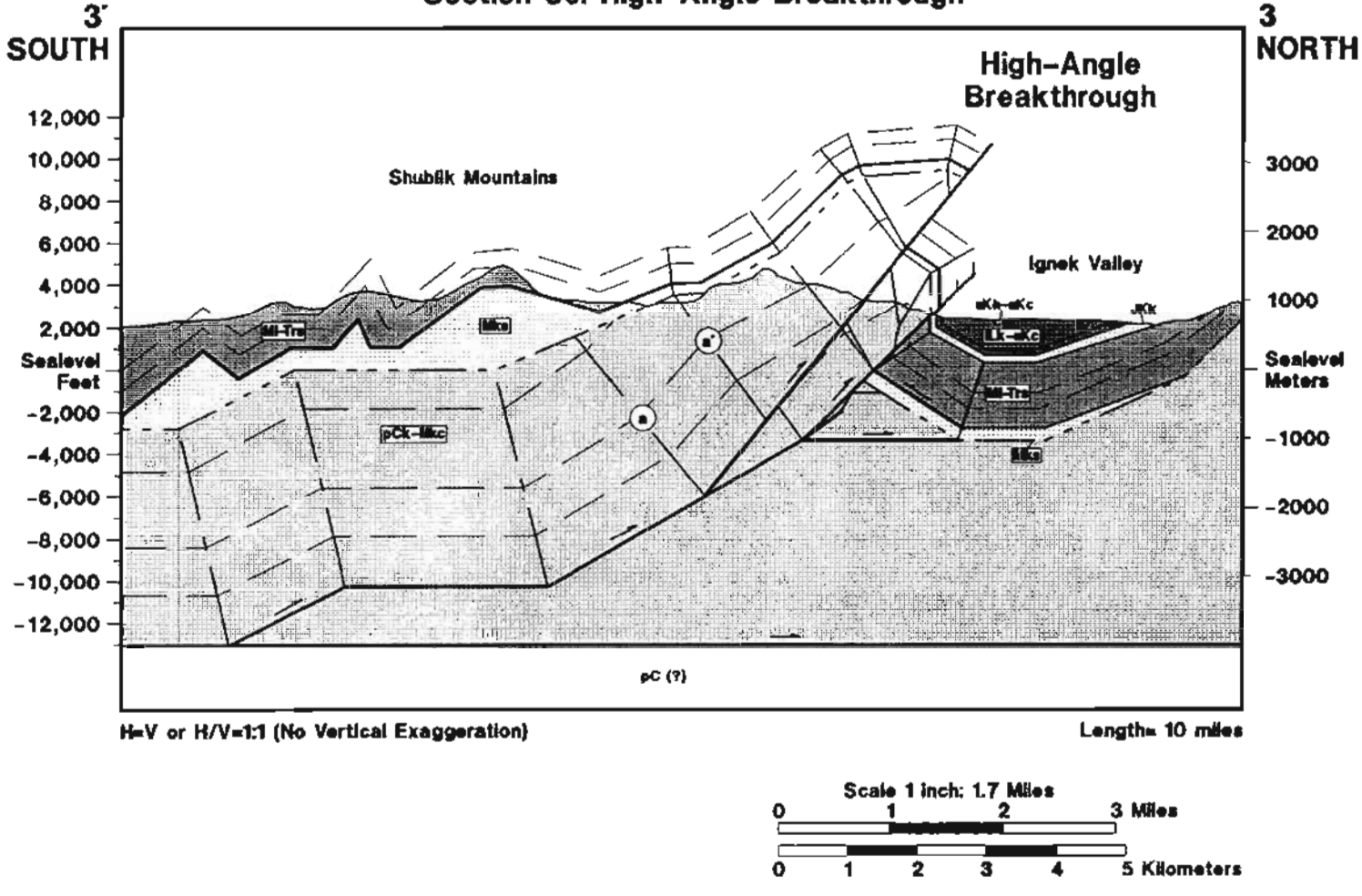



Central Shublik Mountains & Ignek Valley
Section 3c: Fault-Propagation Fold
3'
SOUTH
3
NORTH
12,000
10,000
8,000
6,000
4,000
2,000
Sealevel
Feet
-2,000
-4,000
-6,000
-8,000
-10,000
-12,000
3000
2000
1000
Sealevel
Meters
-1000
-2000
-3000
Shublik Mountains
Fault-Propagation
Fold
Ignek Valley
C
C'
D
D'
Mi-Tr
pCk-Mkc
pC (?)
H=V or H/V=1:1 (No Vertical Exaggeration)
Length=11.7 Miles
Scale 1 inch: 1.7 Miles
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers

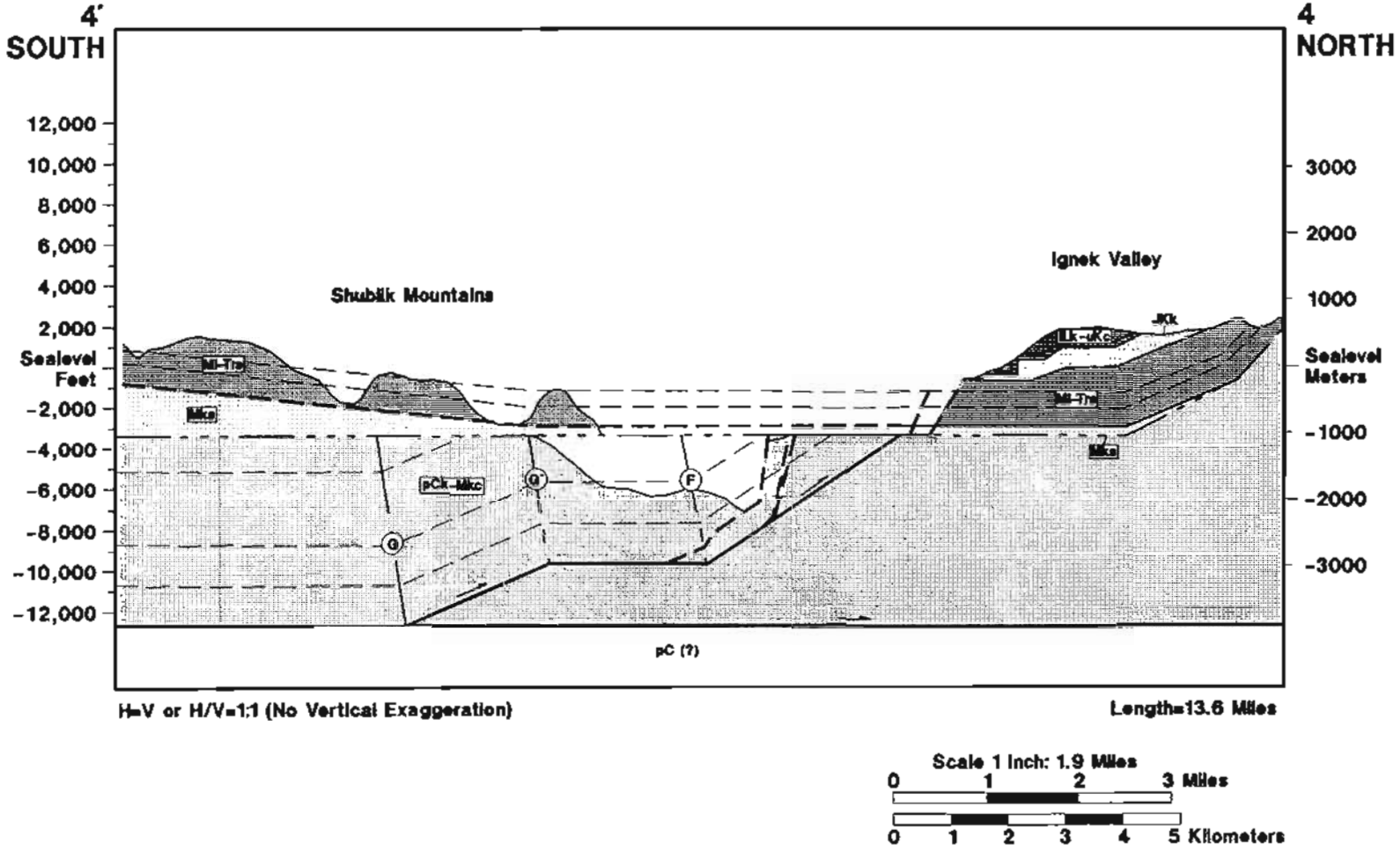
Central Shublik Mountains & Ignek Valley
Section 3d: Low-Angle Breakthrough



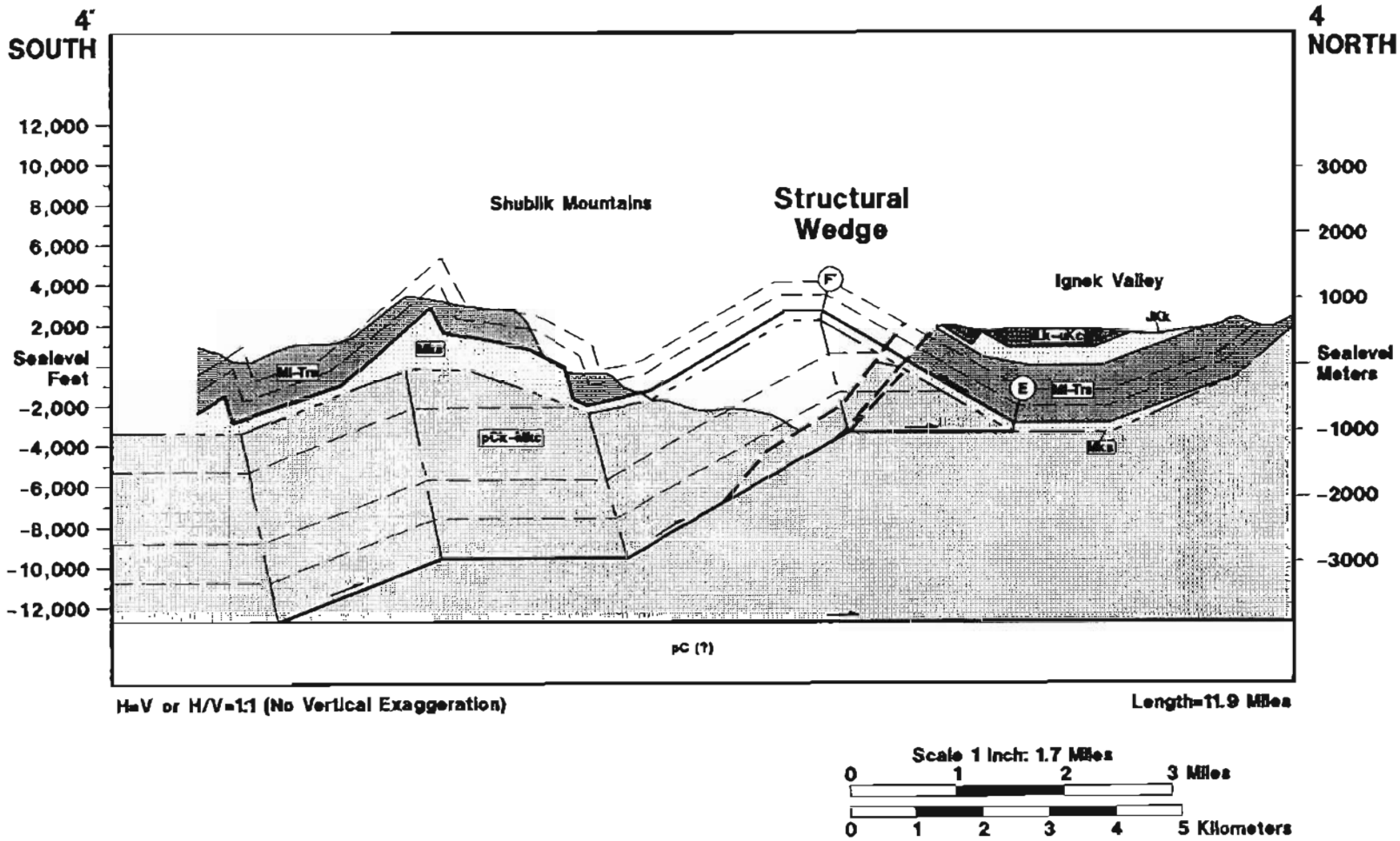
Central Shublik Mountains & Ignek Valley
Section 3e: High–Angle Breakthrough



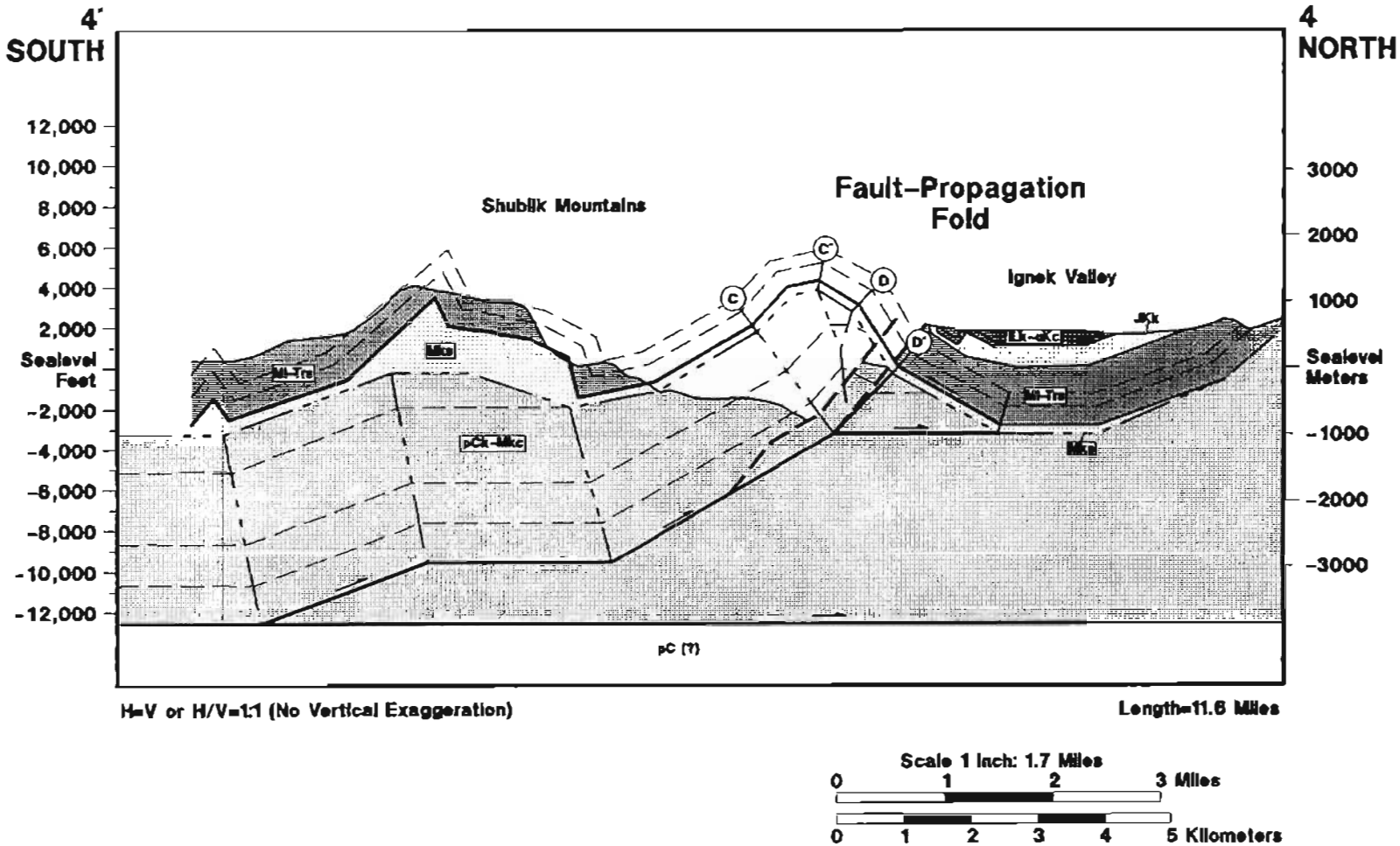
Central Shublik Mountains & Ignek Valley
Section 4a: Restored Section

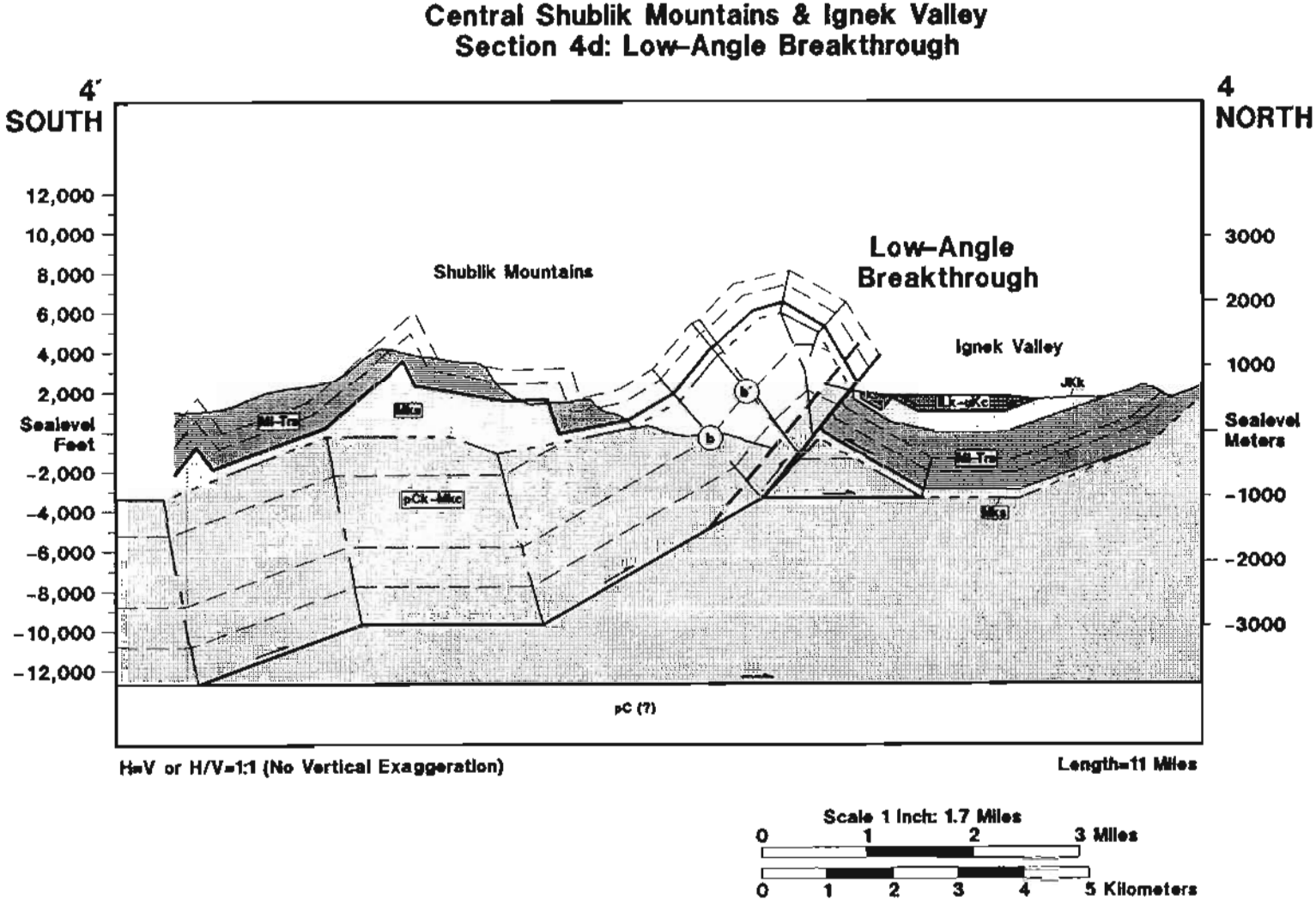


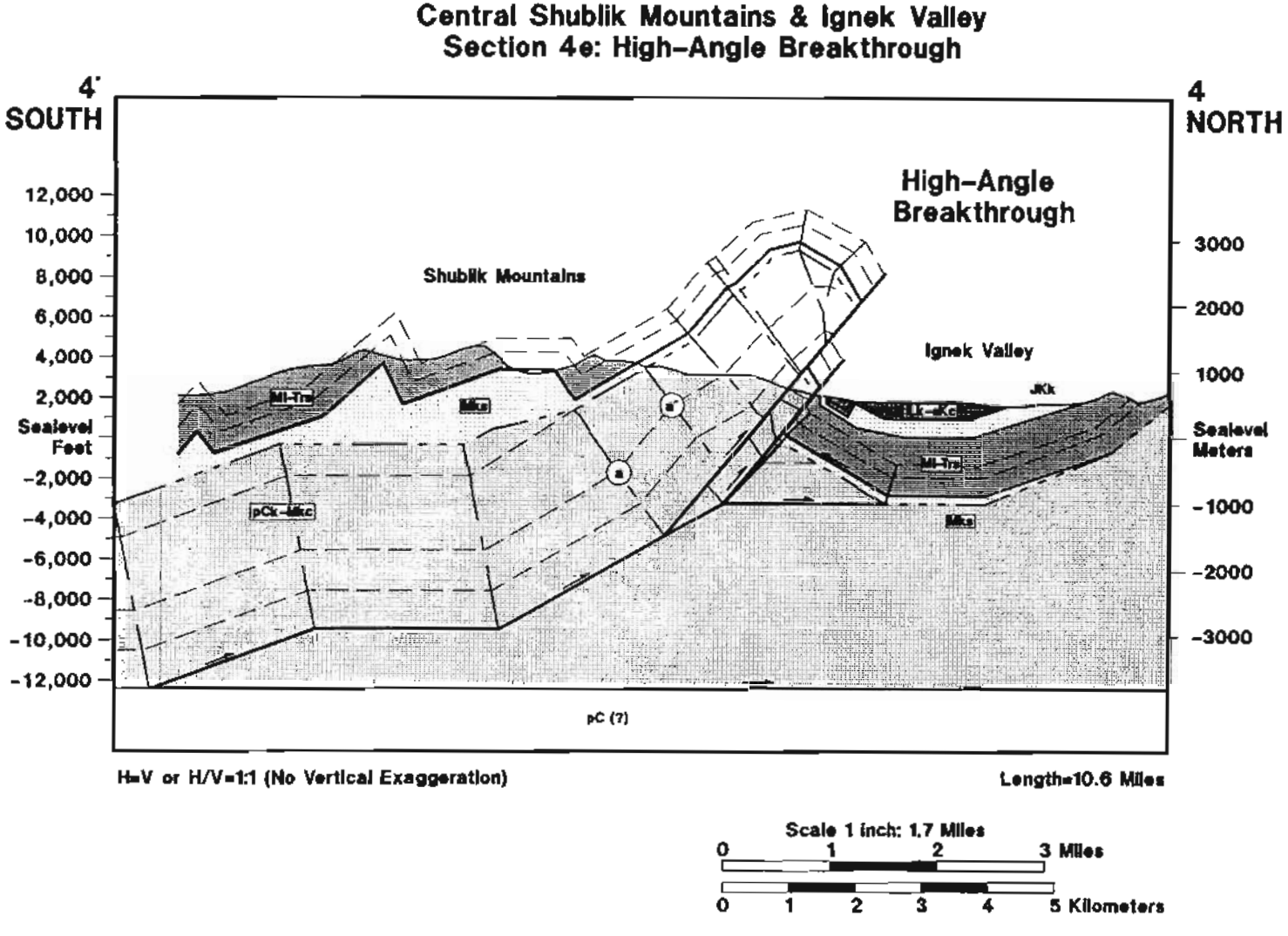
Central Shublik Mountains & Ignek Valley
Section 4b: Structural Wedge



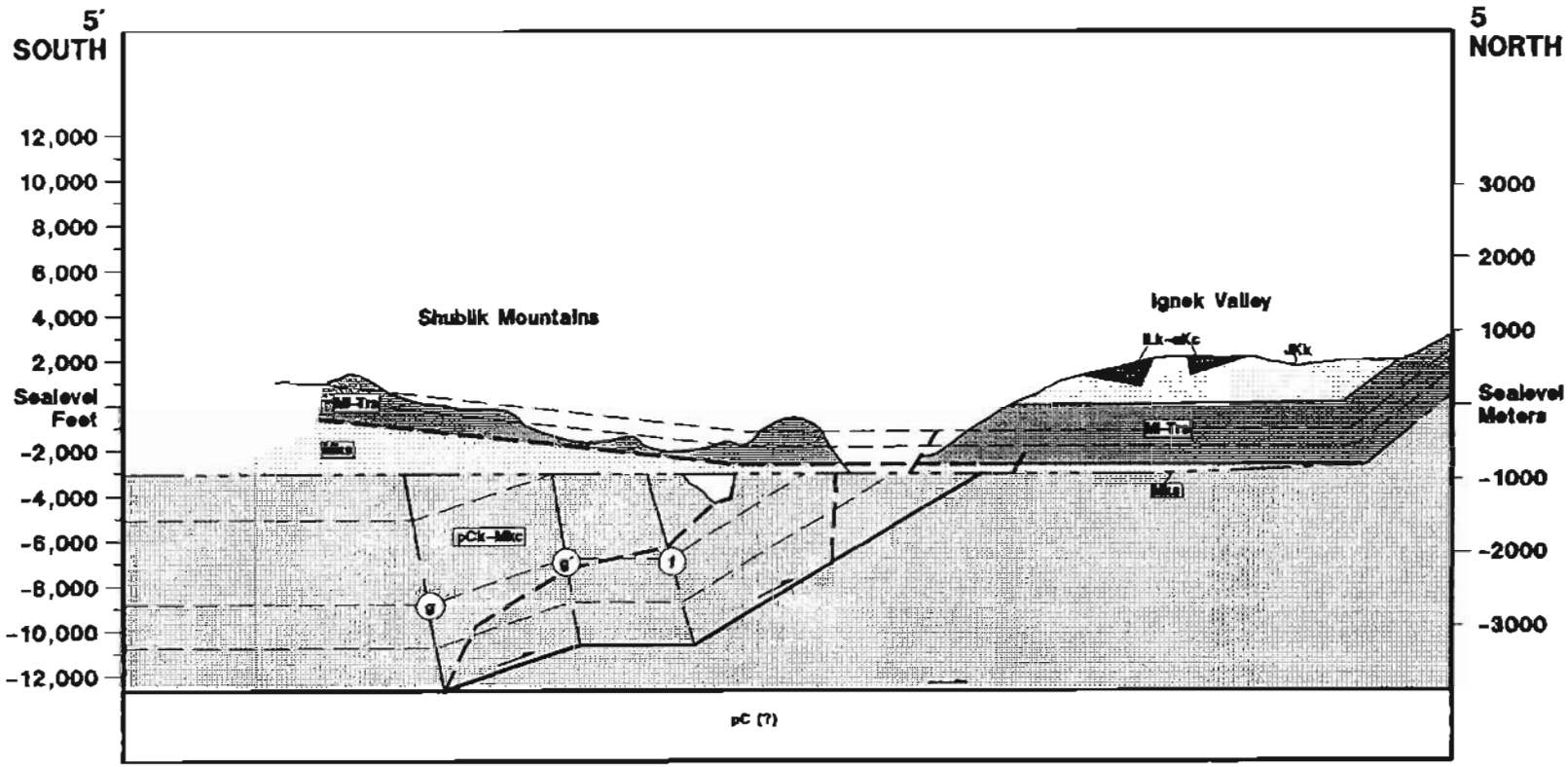
Central Shublik Mountains & Ignek Valley
Section 4c: Fault-Propagation Fold




Central Shublik Mountains & Ignek Valley
Section 4d: Low-Angle Breakthrough
4'
SOUTH
4
NORTH
12,000
10,000
8,000
6,000
4,000
2,000
Sealevel
Feet
-2,000
-4,000
-6,000
-8,000
-10,000
-12,000
3000
2000
1000
Sealevel
Meters
-1000
-2000
-3000
Shublik Mountains
Low-Angle
Breakthrough
Ignek Valley
JKk
Mk-Tm
Mkc
pCk-Mkc
Mks
pC (?)
H=V or H/V=1:1 (No Vertical Exaggeration)
Length=11 Miles
Scale 1 Inch: 1.7 Miles
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers


Central Shublik Mountains & Ignek Valley
Section 4e: High-Angle Breakthrough
4'
SOUTH
4
NORTH
High-Angle
Breakthrough
Shublik Mountains
Ignek Valley
JKk
Mi-Trs
Mks
pCk-Mkc
Lk-Kc
pC (?)
12,000
10,000
8,000
6,000
4,000
2,000
Sealevel
Feet
-2,000
-4,000
-6,000
-8,000
-10,000
-12,000
3000
2000
1000
Sealevel
Meters
-1000
-2000
-3000
H=V or H/V=1:1 (No Vertical Exaggeration)
Length=10.6 Miles
Scale 1 inch: 1.7 Miles
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers

Central Shublik Mountains & Ignek Valley
Section 5a: Restored Section



H=V or H/V=1:1 (No Vertical Exaggeration

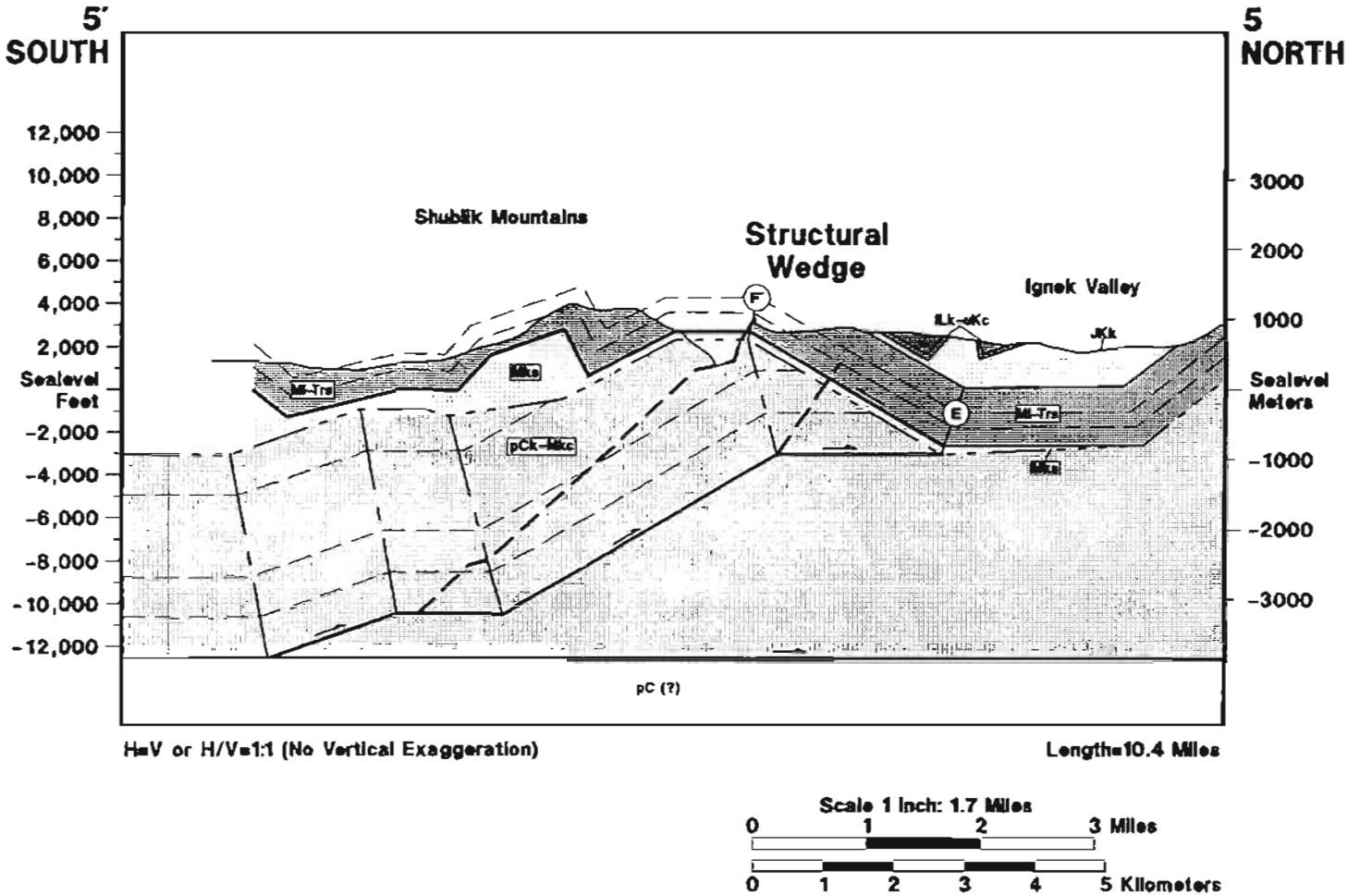
Length=12 Miles

Scale 1 inch: 1.9 Miles

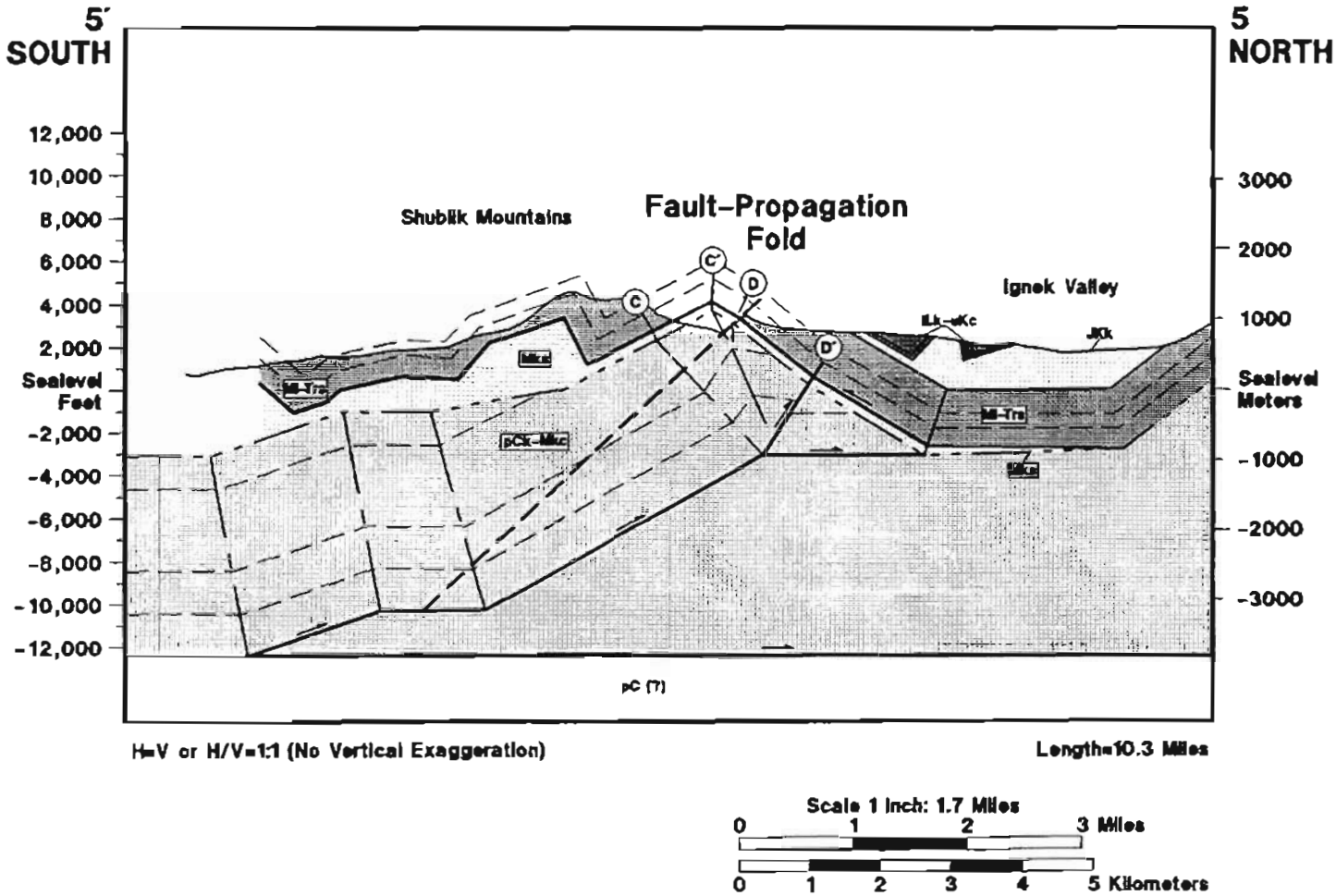
0 1 2 3 Miles

0 1 2 3 4 5 Kilometers

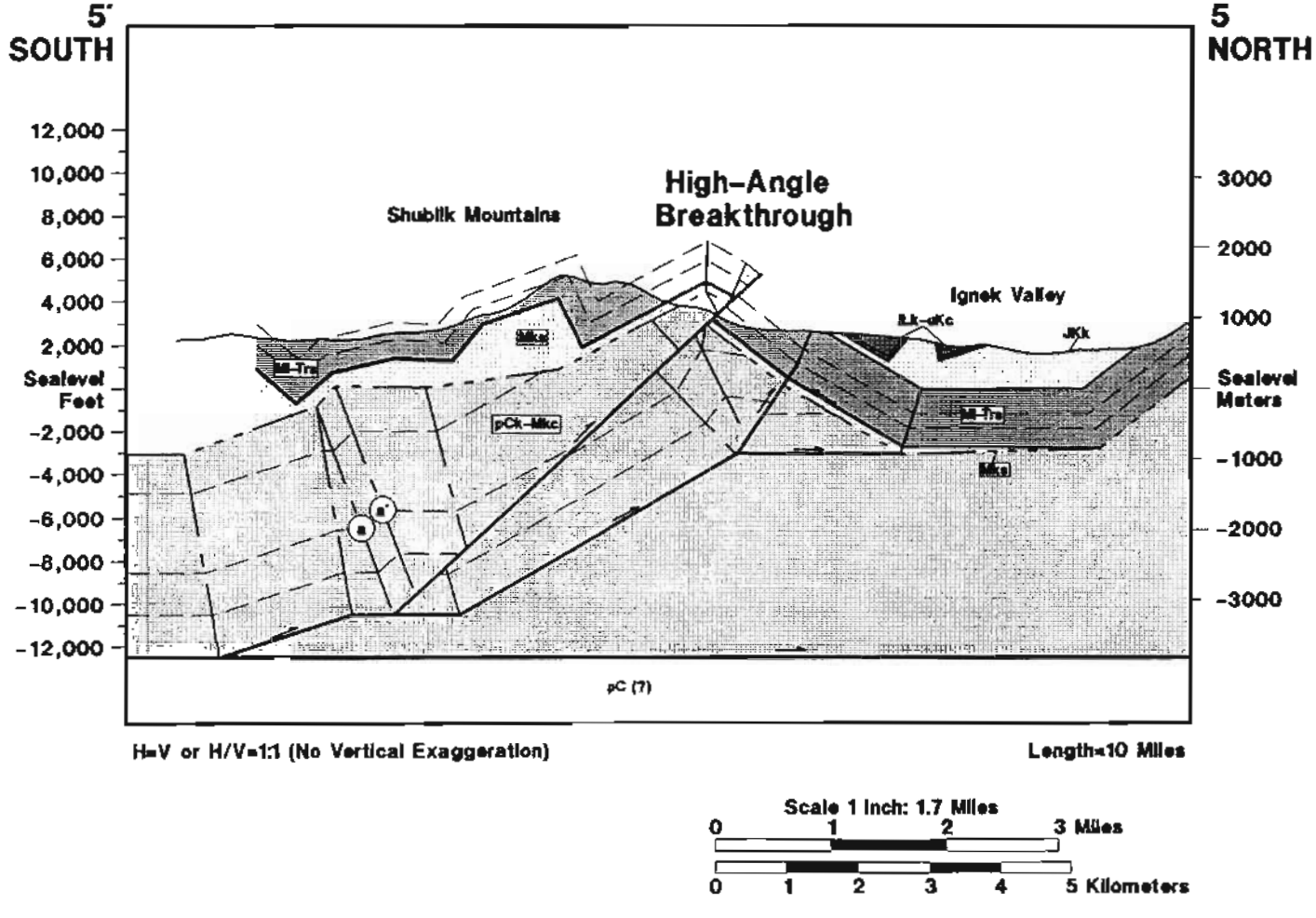
Central Shublik Mountains & Ignek Valley
Section 5b: Structural Wedge



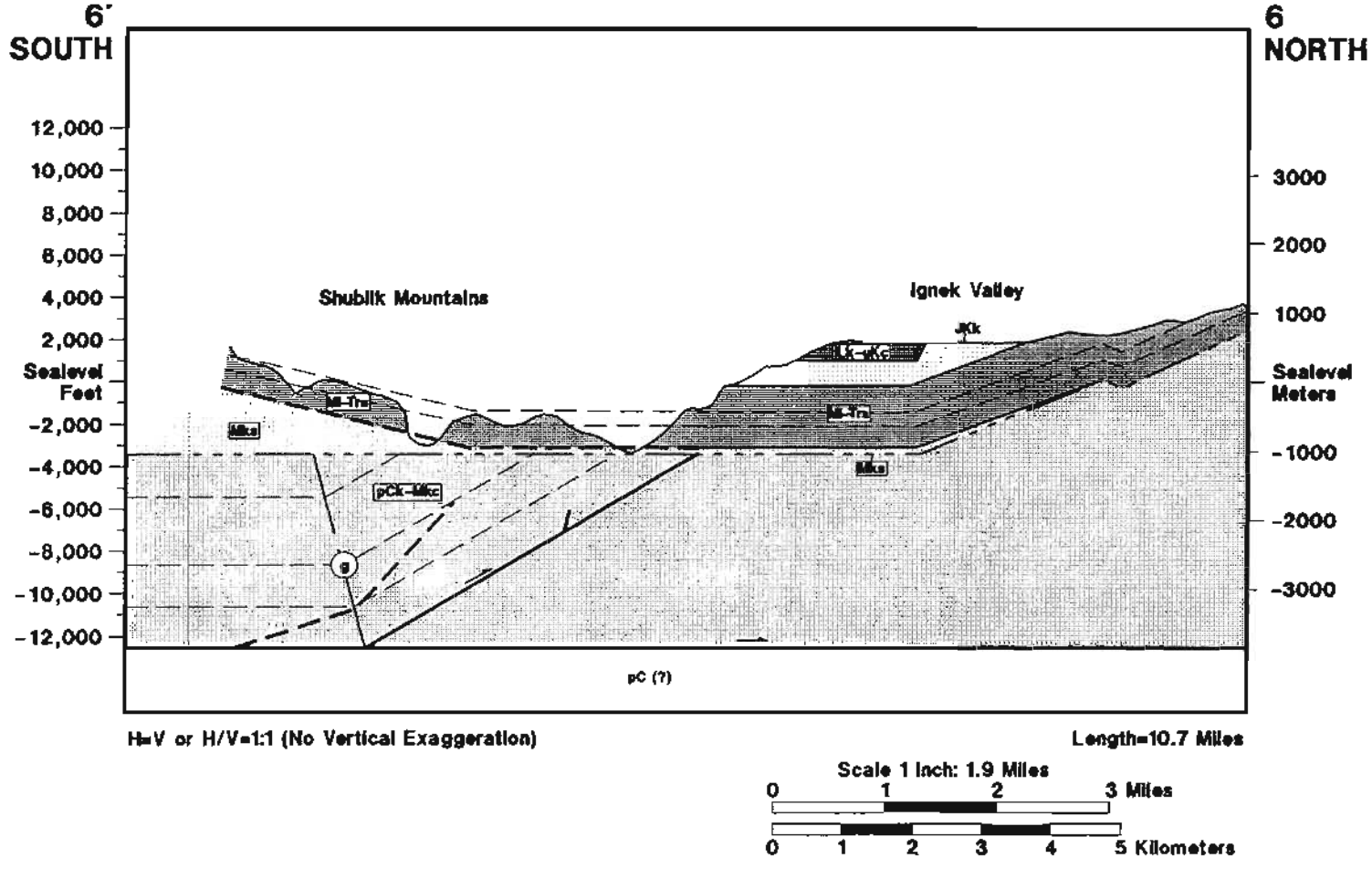
Central Shublik Mountains & Ignek Valley
Section 5c: Fault-Propagation Fold



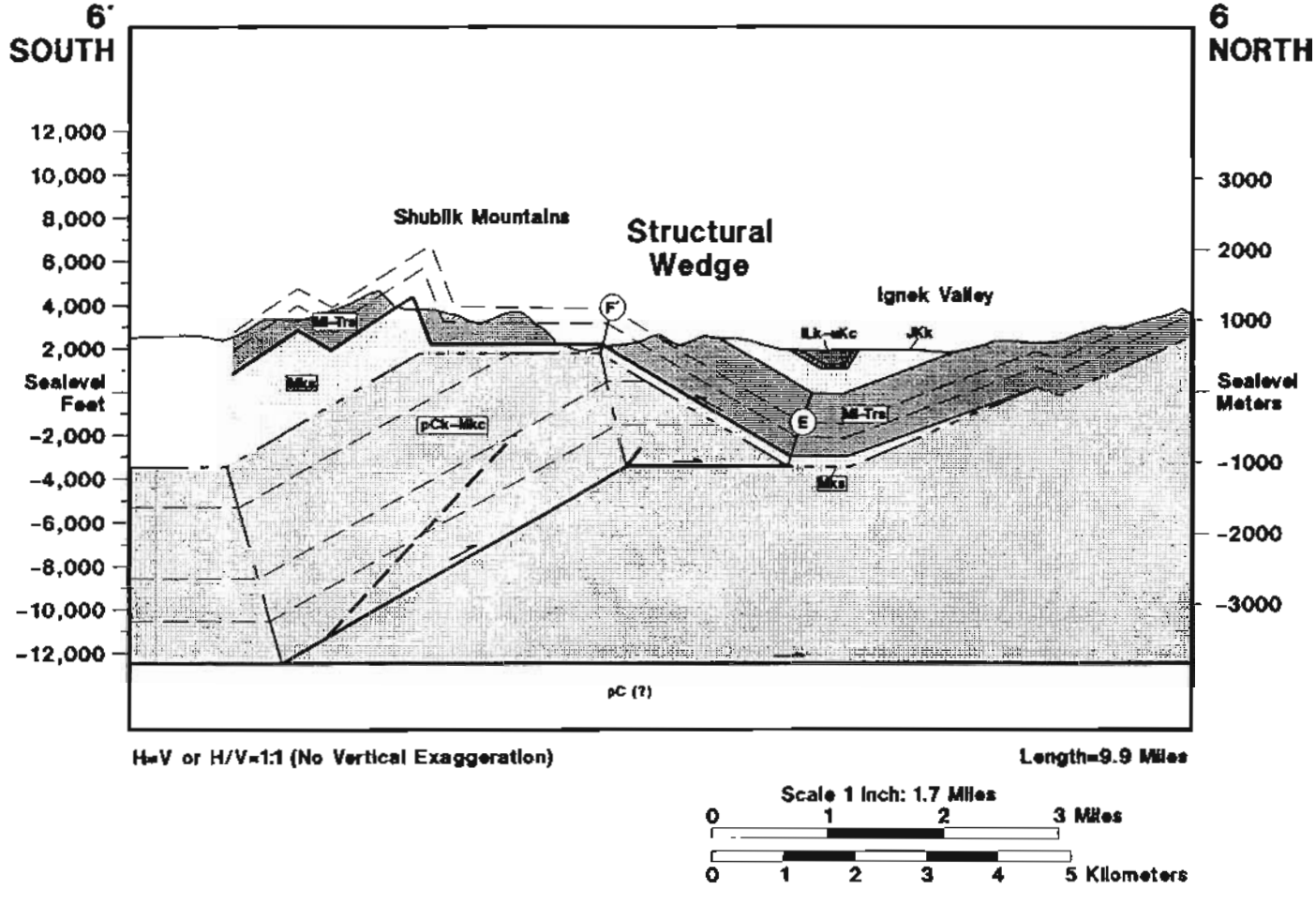
Central Shublik Mountains & Ignek Valley
Section 5d: High-Angle Breakthrough



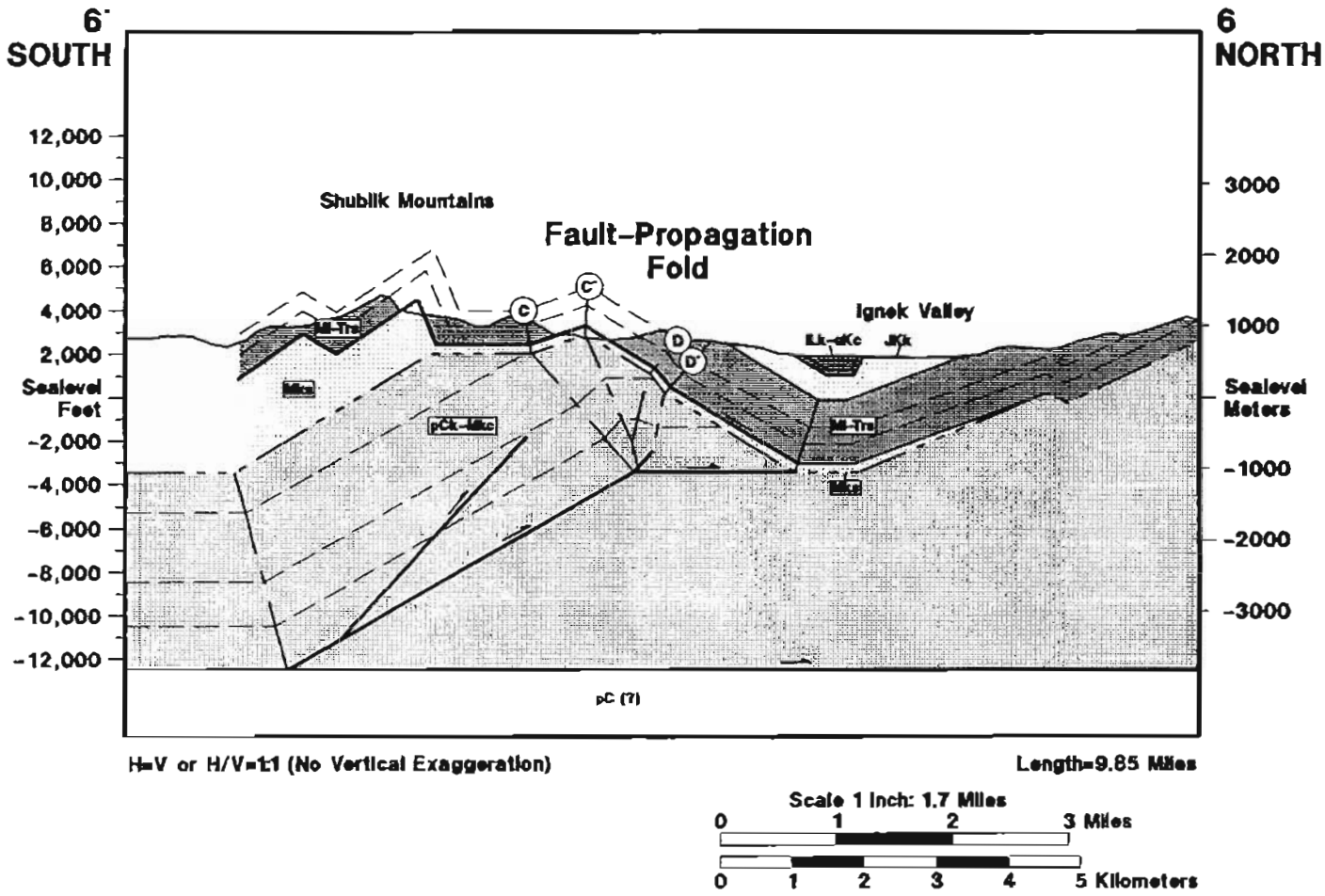
Central Shublik Mountains & Ignek Valley
Section 6a: Reconstructed Section



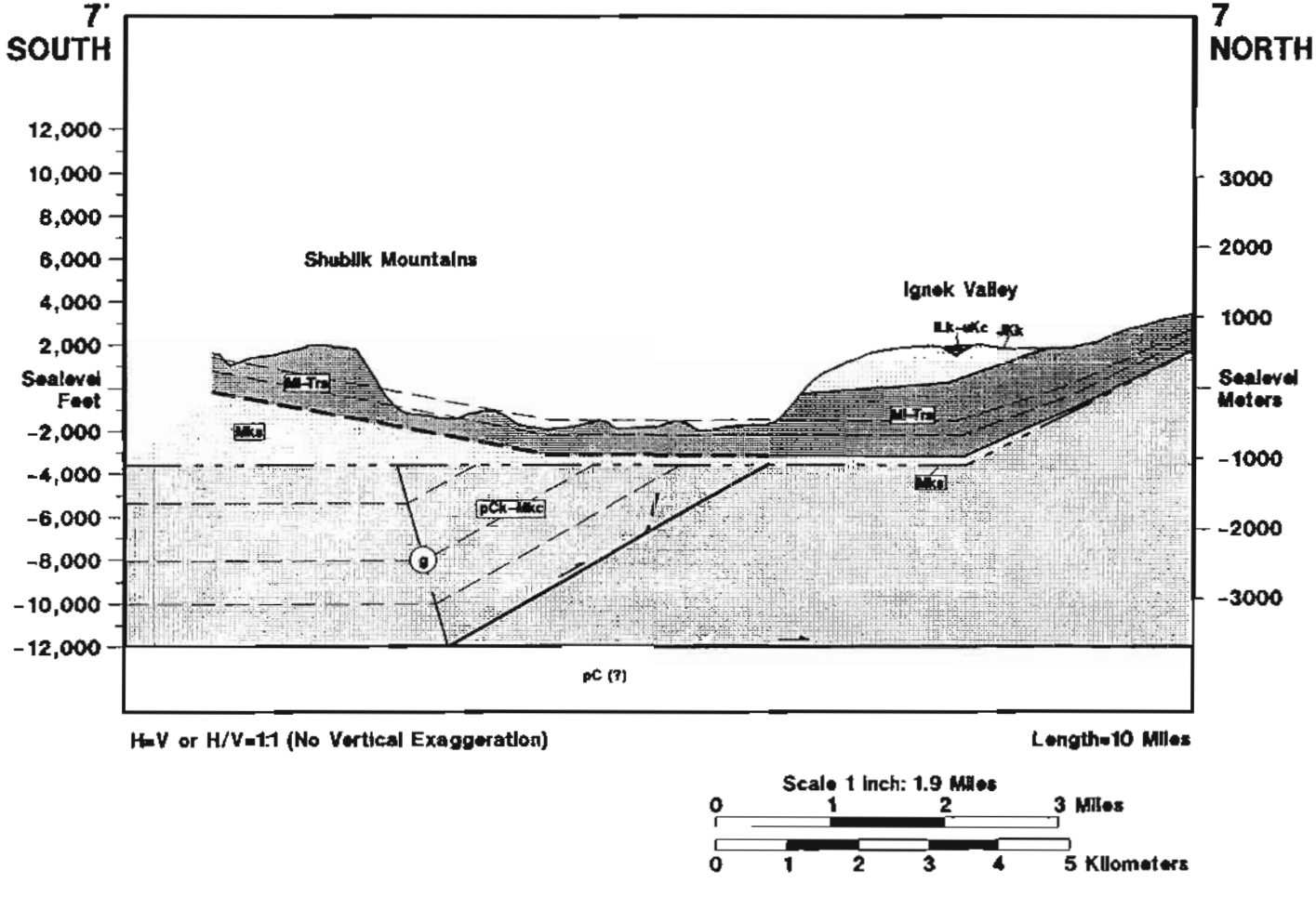
Central Shublik Mountains & Ignek Valley
Section 6b: Structural Wedge

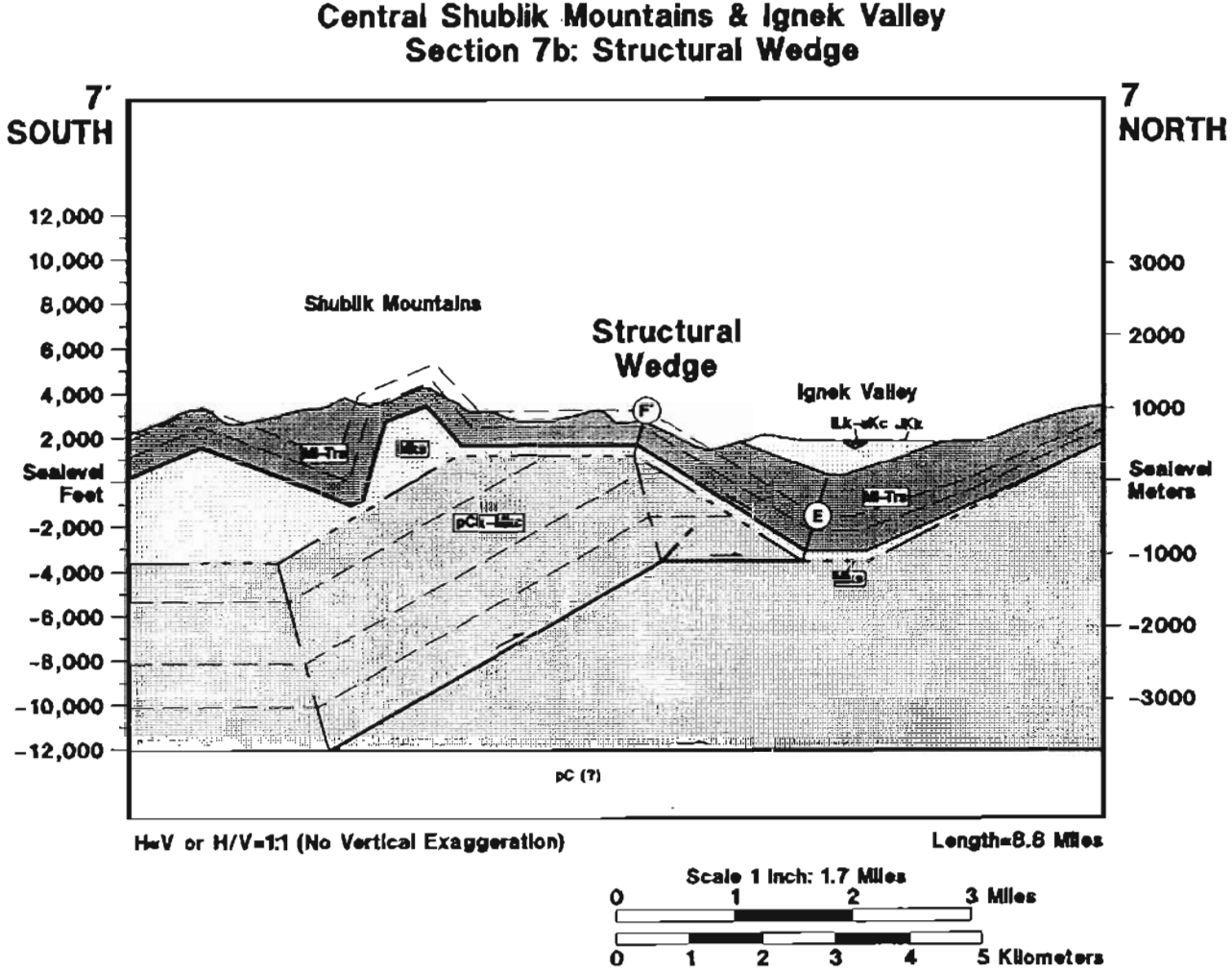


Central Shublik Mountains & Ignek Valley
Section 6c: Fault-Propagation Fold

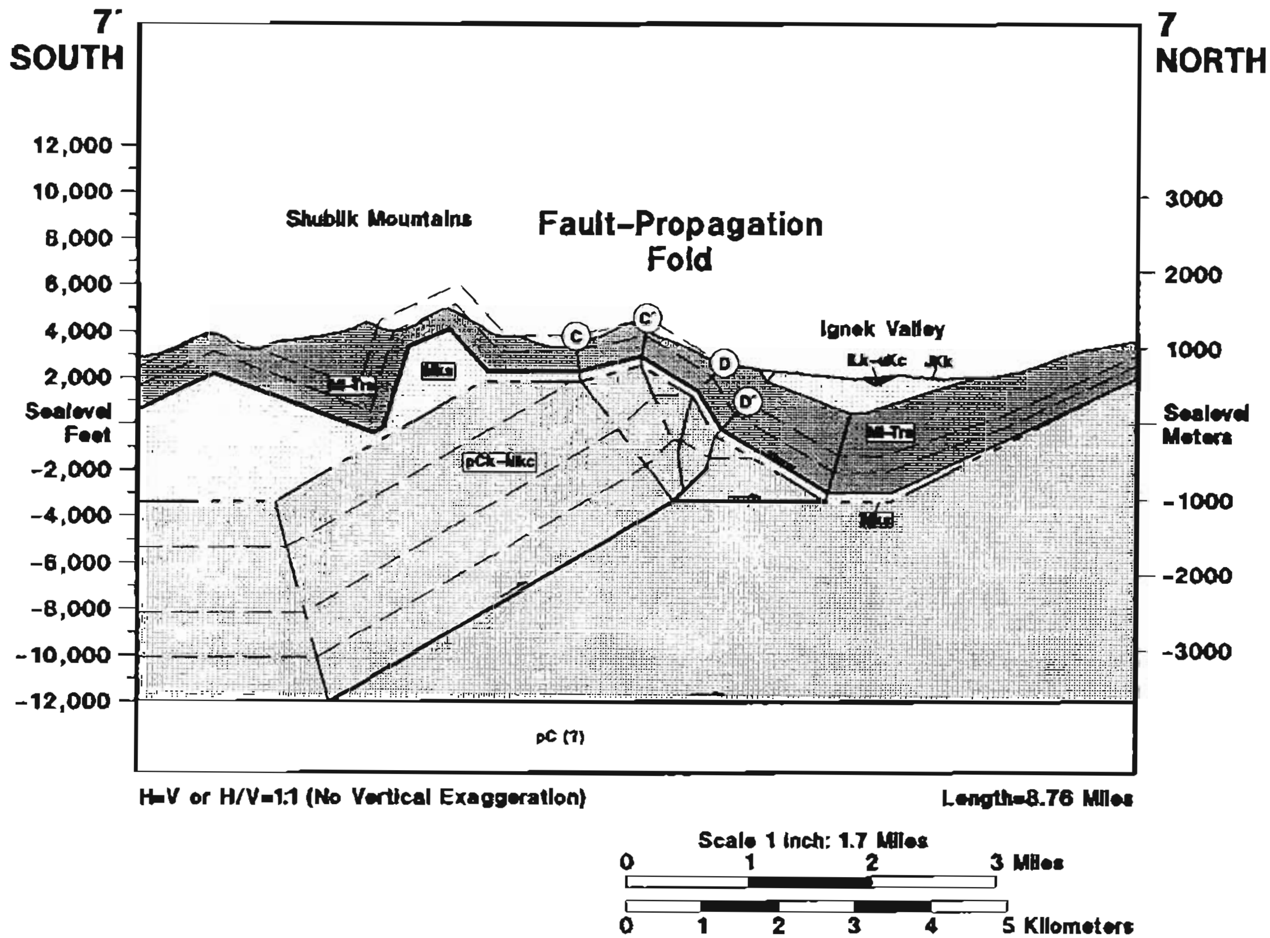


Central Shublik Mountains & Ignek Valley
Section 7a: Restored Section

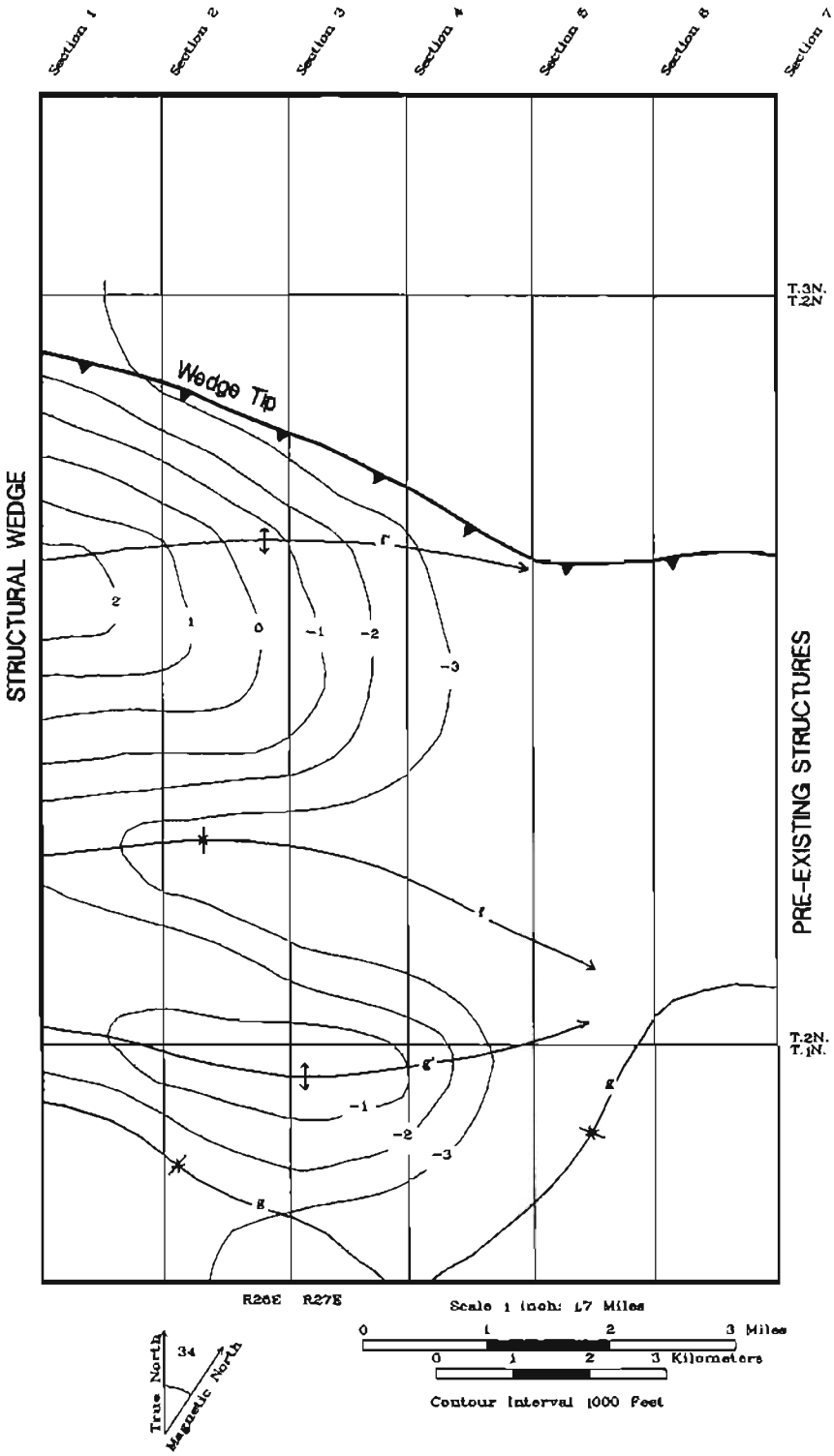



Central Shublik Mountains & Ignek Valley
Section 7b: Structural Wedge
7'
SOUTH
7
NORTH
12,000
10,000
8,000
6,000
4,000
2,000
Sealevel
Feet
-2,000
-4,000
-6,000
-8,000
-10,000
-12,000
3000
2000
1000
Sealevel
Meters
-1000
-2000
-3000
Shublik Mountains
Structural
Wedge
Ignek Valley
F
E
pC (?)
H=V or H/V=1:1 (No Vertical Exaggeration)
Length=8.8 Miles
Scale 1 Inch: 1.7 Miles
0 1 2 3 Miles
0 1 2 3 4 5 Kilometers

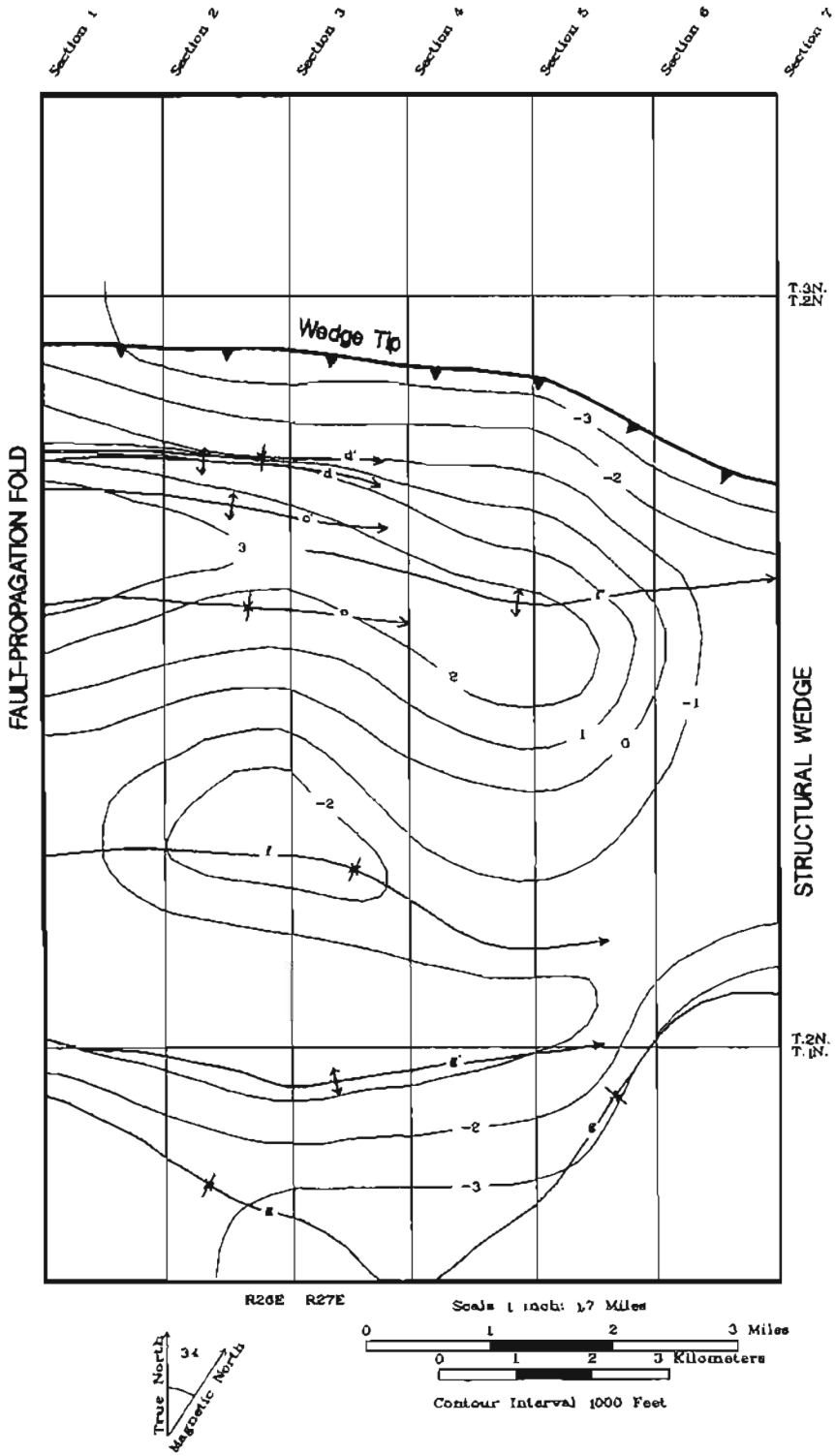
Central Shublik Mountains & Ignek Valley
Section 7c: Fault-Propagation Fold



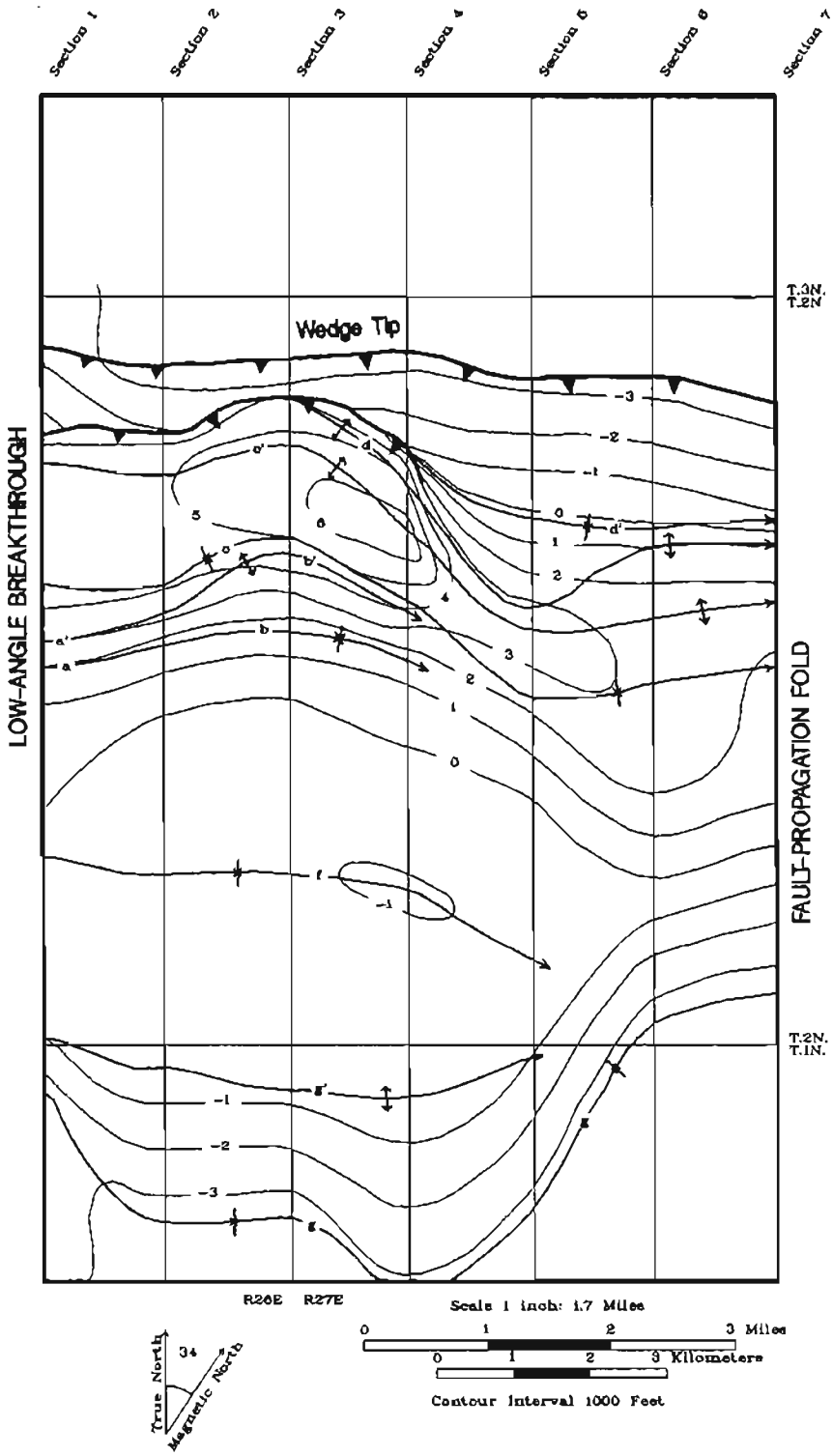
Structural Contour Map of the Pre-Mississippian Unconformity
Showing the Evolution of the Structural Wedge



Structural Contour Map of the Pre-Mississippian Unconformity
Showing the Evolution of the Fault-Propagation Fold



Structural Contour Map of the Pre-Mississippian Unconformity
Showing the Evolution of the Low-Angle Breakthrough



Structural Contour Map of the Pre-Mississippian Unconformity
Showing the Evolution of the Out-of-Sequence Fault