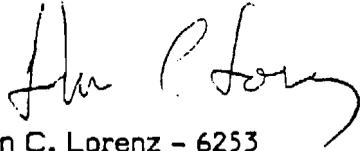


date: January 19, 1983

to: Memorandum of Record

from: John C. Lorenz - 6253



subject: Paludal Zone Sedimentology

This memo is a summary of the available sedimentological data for the five stimulation targets in the paludal zone (6600-7450 feet deep, Fig. 1) at the Multi-Well Experiment site. Interpretations are based on slabbed core where available, supplemented by the gamma ray logs of the uncored intervals. Correlation horizons between wells (top of the sandstone or an adjacent coal) are shown by dashed lines.

The attempt is made to describe the sedimentology, and then to interpret as closely as possible the depositional environments and the expected reservoir size and orientation with respect to the three MWX wells. Sand body widths are derived from height to width relationships observed in outcrops:

$$\text{width} = 8.6 (\text{height})^{1.1}$$

(correlation coefficient 0.62)

Reservoir orientations are interpreted from the spatial relationships of the three wells at depth (Fig. 2) and the specific subenvironment (channel margin vs main channel) penetrated by each well.

This memo represents the best interpretations which can be made with the existing core and geophysical log data. Because the main channel sands were not penetrated in this paludal zone in MWX-3 (the only well drilled with water-based mud), crossbed information which would help in determination of lens orientation is not available from dipmeter logs. Crossbedding in core from MWX-1 and MWX-2 has not provided definitive results.

#### Zone 1 (Fig. 3)

MWX-2 core suggests a channel margin sequence. Core is missing in the thickest sand area, which may have been part of a channel. The coarsening-upwards nature suggests that the main channel was migrating toward MWX-2 prior to abandonment. The MWX-1 gamma ray log is sandier and may indicate a position in the associated channel lens. The MWX-3 gamma ray log suggests a sandstone and mudstone distal channel margin sequence similar to the lower part of the MWX-2 core, without

density log crossovers. The main channel for this zone probably runs generally east-west just south of the MWX site, although it is possible that it may edge into MWX-1.

#### Zone 2 (Fig. 4)

MWX-2 core shows a distinctive repetitive sequence of clay-ripup conglomerates in a sandstone matrix, with abundant scour surfaces. This suggests that the core penetrated a proximal levee/splay deposit, where each successive flood episode ripped up the veneer of clay left by the previous flood as it spewed sand over the top of the riverbanks into a coal swamp. The sequence grades up into lower-energy rooted/massive sandstones and interlayered mudstones typical of a levee. The MWX-1 downhole gamma ray log is more uniform, with good density log crossovers, suggesting the main channel was penetrated.

The MWX-3 density logs have no crossovers, and the gamma ray log suggests a sandstone and mudstone channel margin sequence. The main channel of Zone 2 probably runs generally northeast-southwest through MWX-1, only the feather edge being penetrated by MWX-2 and -3. Based on outcrop height-to-width relationships in the coastal zone at Coal Canyon north of Debeque, and assuming that the 46-foot thickness penetrated by MWX-1 is the maximum channel thickness, this channel should be about 550 feet wide.

#### Zone 3 (Fig. 5)

MWX-2 core shows a good sequence of crossbedded and rippled sands with few mudstones. This, plus the basal scour surfaces and clay-ripup conglomerates suggest a main channel was penetrated. Core from MWX-3 shows a similar but thinner sandstone which is probably also in the main channel but close to the edge. The MWX-1 gamma ray log also indicates a sandy sequence, probably main channel. This channel probably runs east-northeast, generally parallel to and centered on the line between MWX-1 and MWX-2, but encompassing MWX-3 at its edge. Based on its 28-foot thickness, it should be on the order of 350 feet wide.

#### Zone 4 (Fig. 6)

Core from MWX-3 consists almost entirely of rippled and carbonaceous sandstone, without any of the crossbedding indicative of main channels. This type of rippled sandstone occurs primarily in splays, the flood deposits adjacent to channels. Zone 4 is split in MWX-2 by a coaly zone; only the lower half was cored. This core displays the thinly-laminated and extensively burrowed deposits which occur at the subaqueous toes of splays. The gamma ray log from MWX-1 is similar in shape and thickness to that of MWX-3, and thus Zone 4 in this well is interpreted to be similar to the splay in MWX-3.

Zone 4 is interpreted to be a thick splay deposit which thins in the direction of MWX-2, and the parent channel of which is probably within hundreds of feet to the north and east of the MWX site.

Zone 5 (Fig. 7)

The gamma ray logs for zone 5 in MWX-1 and MWX-2 indicate sandy zones with density log crossovers, and are probably main channel deposits. Maximum thickness is 17 feet, which indicate a channel width of 200 feet. The core of this zone in MWX-3 is a rippled sandstone and carbonaceous mudstone sequence of a channel margin/floodplain environment. The zone 5 channel probably runs east-west through MWX-1 and MWX-2, with MWX-1 being closer to the edge of the channel.

fig. 1

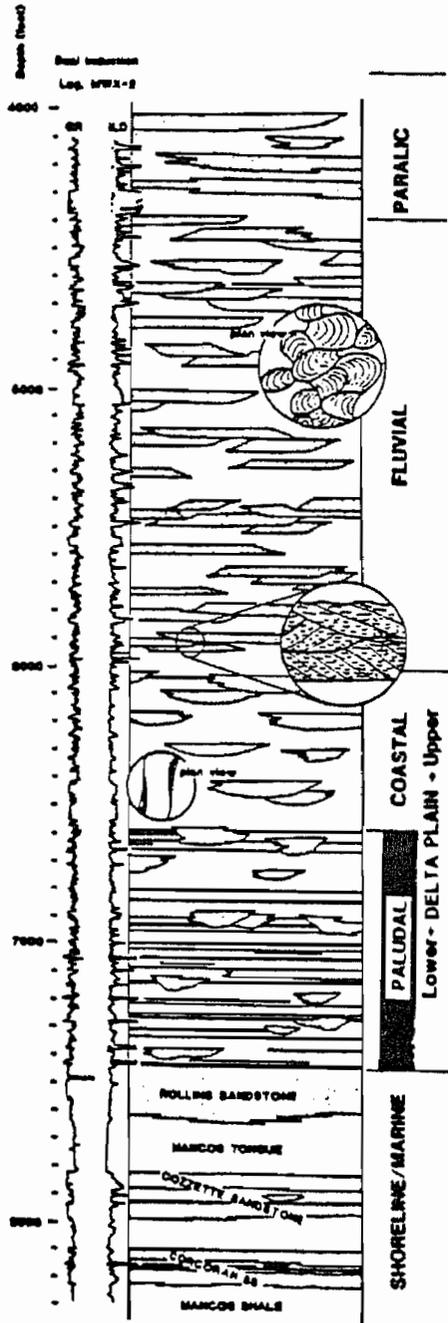
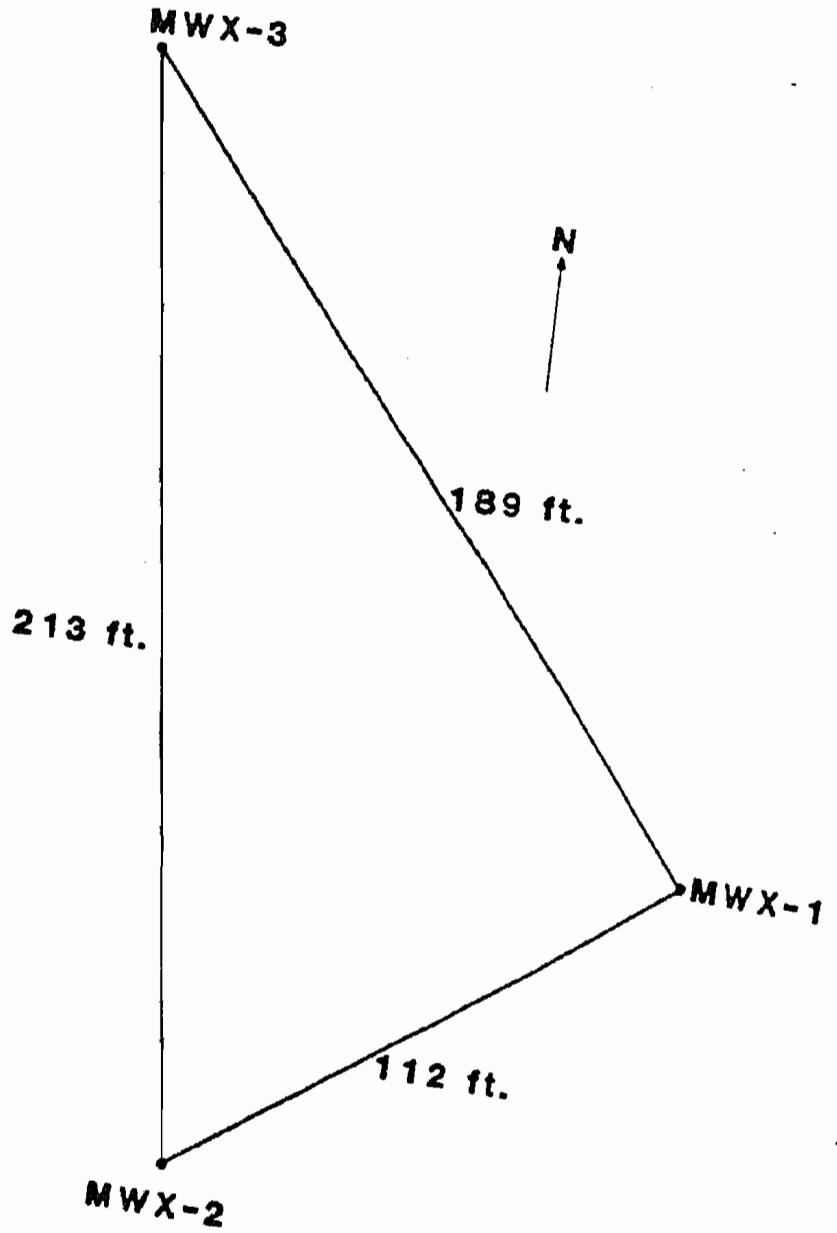
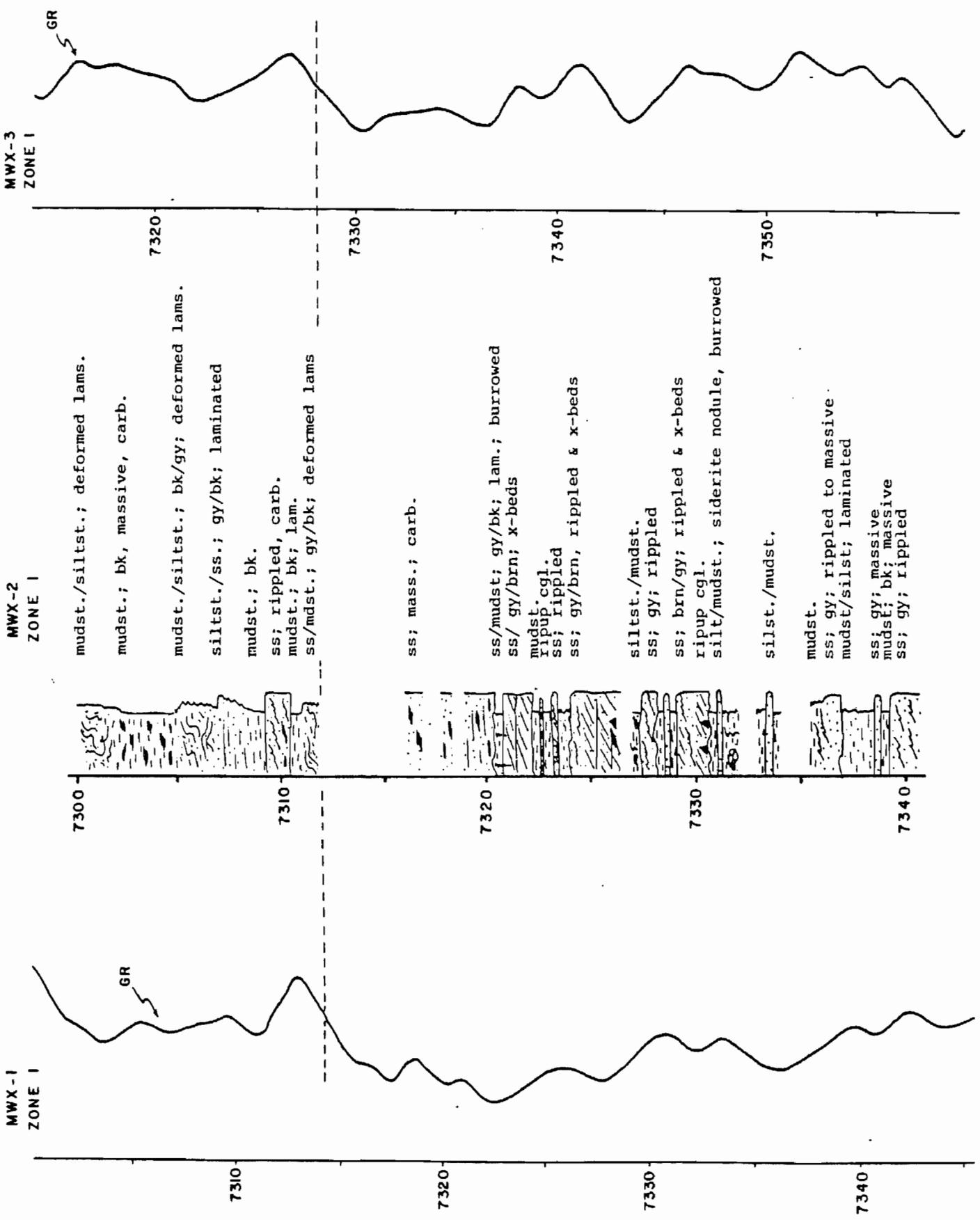


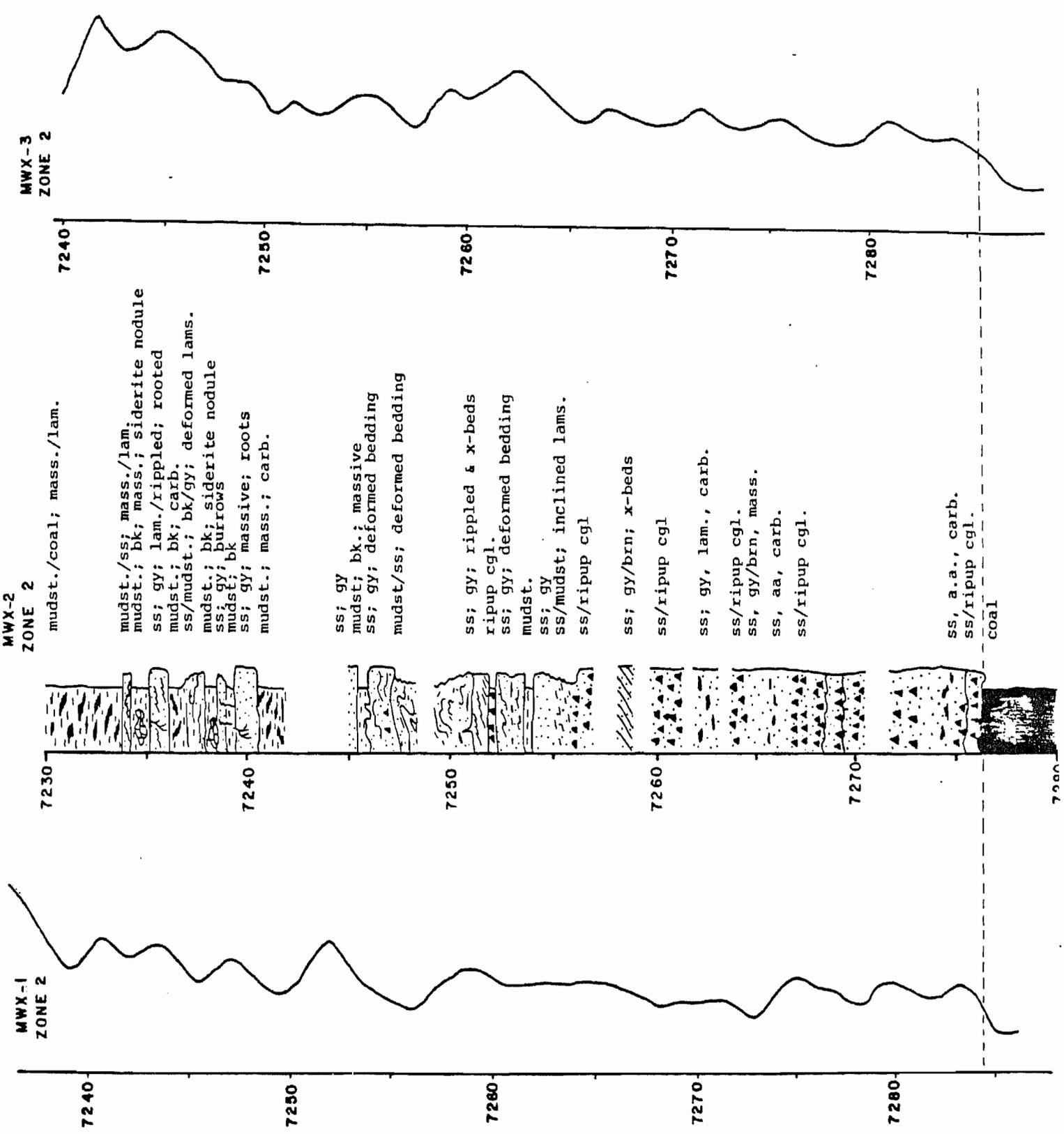
fig. 2



Relative Separations at 7000 ft.

fig. 3





MWX-2  
ZONE 2

mudst./coal; mass./lam.

mudst./ss; mass./lam.  
 mudst.; bk; mass.; siderite nodule  
 ss; gy; lam./rippled; rooted  
 mudst.; bk; carb.  
 ss/mudst.; bk/gy; deformed lams.  
 mudst.; bk; siderite nodule  
 ss; gy; burrows  
 mudst.; bk  
 ss; gy; massive; roots  
 mudst.; mass.; carb.

ss; gy  
 mudst; bk.; massive  
 ss; gy; deformed bedding  
 mudst/ss; deformed bedding

ss; gy; rippled & x-beds  
 ripup cgl.  
 ss; gy; deformed bedding  
 mudst.  
 ss; gy  
 ss/mudst; inclined lams.  
 ss/ripup cgl

ss; gy/brn; x-beds

ss/ripup cgl

ss; gy, lam., carb.

ss/ripup cgl.

ss, gy/brn, mass.

ss, aa, carb.

ss/ripup cgl.

ss, a.a., carb.  
 ss/ripup cgl.

coal

MWX-1  
ZONE 2

7240

7250

7260

7270

7280

7230

7240

7250

7260

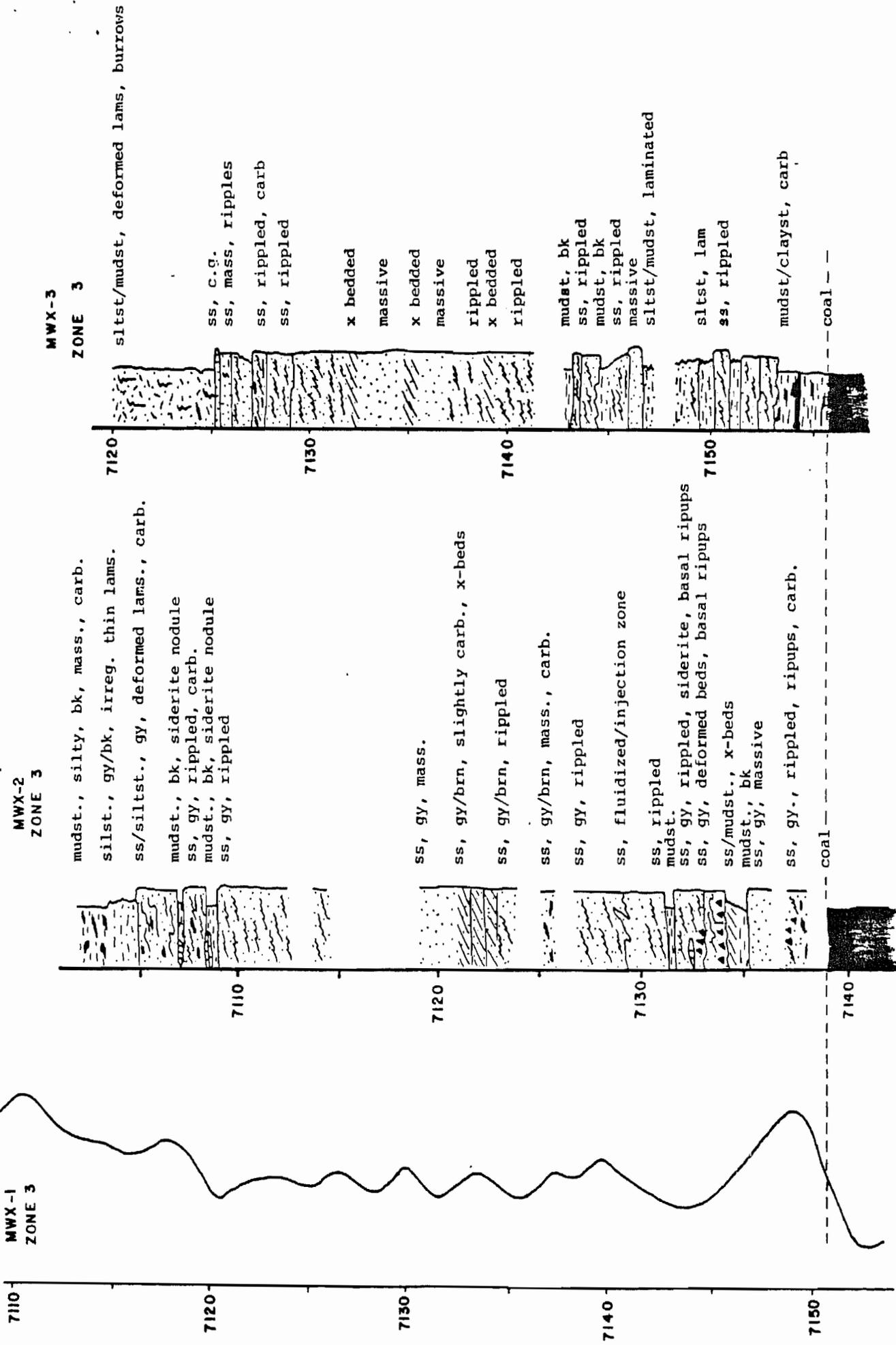
7270

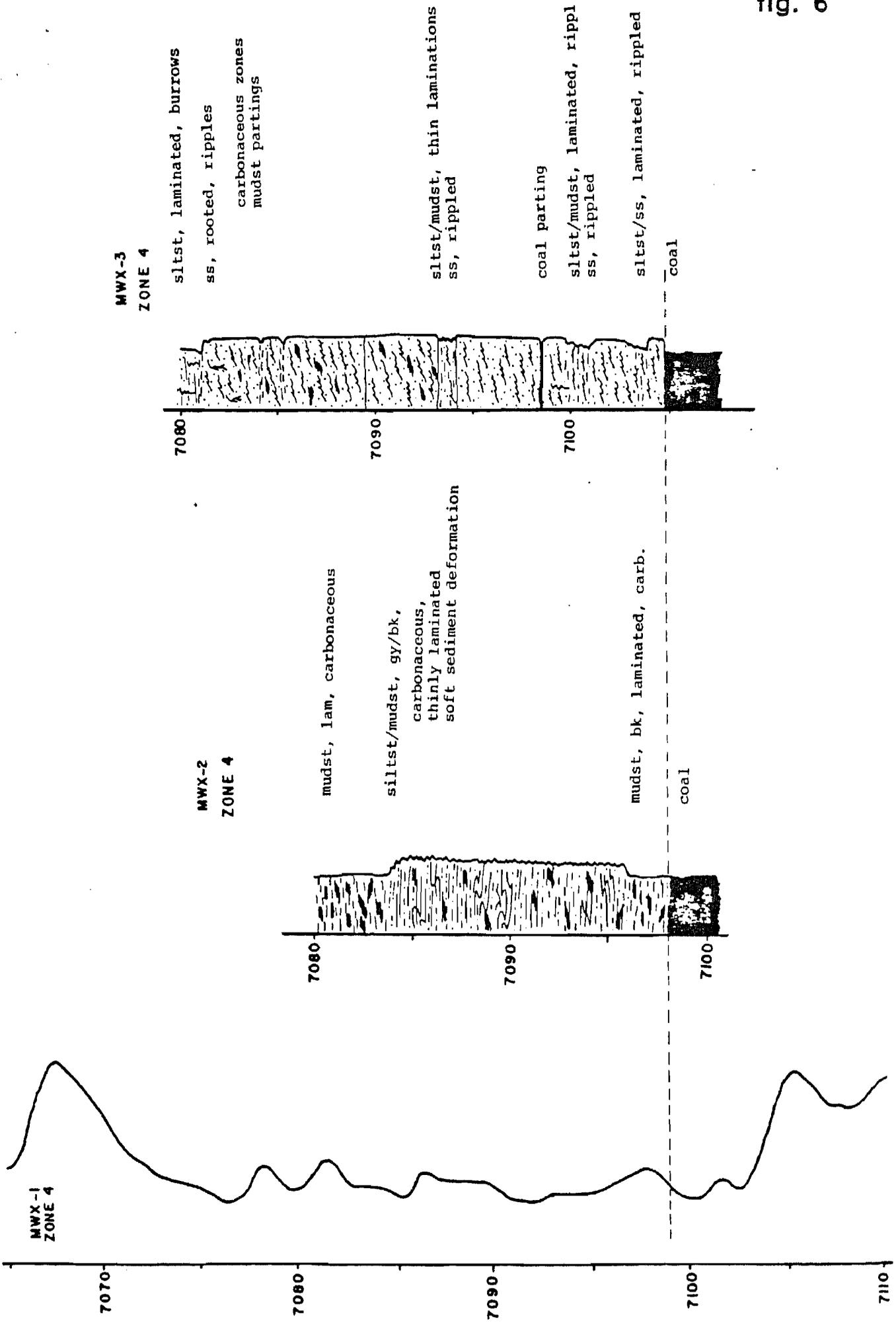
7280

MWX-1  
ZONE 3

MWX-2  
ZONE 3

MWX-3  
ZONE 3





**MWX-3  
ZONE 5**

ss, rippled, carb

mudst, bk, lam, carb

sltst, mass  
mudst, bk, carb

ss, mass, rooted  
ss/mudst, laminated

mudst, carb

mudst/sltst, lam, burrowed

clyst, bk, lam, siderite nodule  
sltst, deformed lams

ss, rippled

ss, rippled, deformed, siderite

ss, c.g., mass  
mudst, carb

coal

mudst, carb

sltst/mudst, lam, burrows

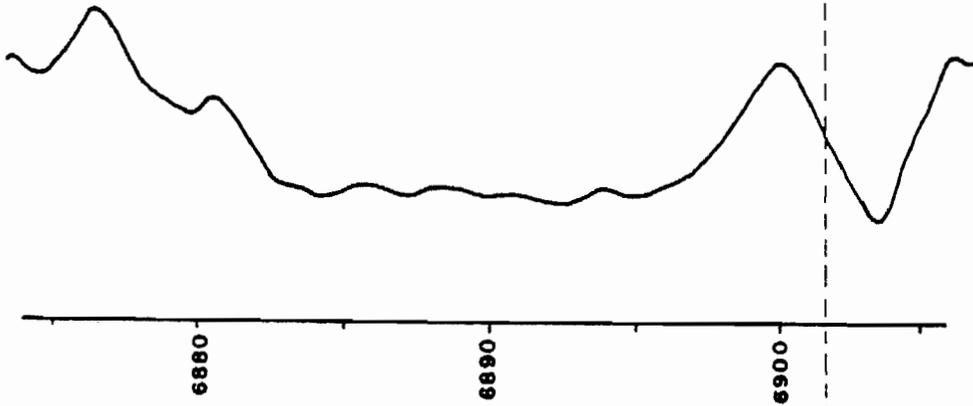
mudst, calcareous

mudst, carb

Coal

**fig. 7**

**MWX-2  
ZONE 5**



**MWX-1  
ZONE 5**

