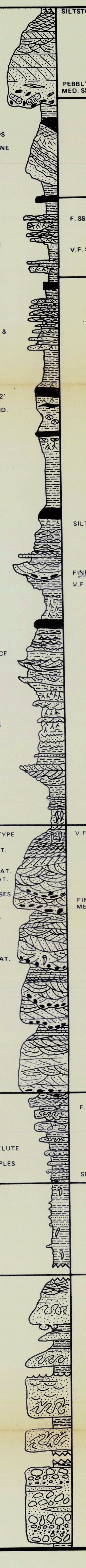
# CHART SUMMARIZING ENVIRONMENTAL INTERPRETATION OF FORTRESS MTN., TOROK, KUKPOWRUK, AND CORWIN FORMATIONS

| Formation | Environment | Sub-environment | Facies | Thickness | Percent Sandstone | Thickness of Sandstone | Lateral Extent of Sandstone | Ø and K (Ø / K) | Cementation |
|---|---|---|---|---|---|---|---|---|---|
| CORWIN FORMATION (NONE-MARINE) | DELTA PLAIN | FLUVIAL-DISTRIBUTARY CHANNELS | POINT BAR | 5.0'–100.0' | ~90–100% | INDIVIDUAL POINT BAR SEQUENCES 5'–40' COMPOSITE SANDS UP TO 100' | GENERALLY LESS THAN 1.0 MILE NEARLY PERPENDICULAR TO PALEOCURRENT DIRECTION. MAX. EXTENT TRACED ~4.0 MI. | 5.43% 1.00 md. RANGE: 1.2–12.2% RANGE: 0–8.63 md. 18 SPLS. | |
| CORWIN FORMATION (NONE-MARINE) | DELTA PLAIN | FLUVIAL-DISTRIBUTARY CHANNELS | ABANDONED CHANNEL FILL | 2'–40.0'+ | 10%–60% GENERALLY SILTY, VFSS | BEDS GENERALLY <1.0' THICK SEPARATED BY SILTSTONE + SHALE | CONFINED TO CHANNELS, PROBABLY LESS THAN 1 MILE WIDE. | | |
| CORWIN FORMATION (NONE-MARINE) | DELTA PLAIN | OVERBANK-FLOOD BASIN | CREVASSE SPLAY | 1'–15' | 60%–85% | BEDS GENERALLY 0.5' TO 3.0' THICK SEPARATED BY SILTSTONE + SHALE | NOT DETERMINED. SOME BEDS PINCHOUT WITHIN 100 YARDS. | 4.01% 0.153 md. RANGE: 1–10.4% RANGE: 0–0.72 md. 16 SPLS. | |
| CORWIN FORMATION (NONE-MARINE) | DELTA PLAIN | OVERBANK-FLOOD BASIN | LEVEE | 5'–20' | 40%–90% | BEDS GENERALLY 0.5'–4.0' THICK | ONE OBSERVATION OF SANDSTONE BEDS THIN AWAY FROM CHANNEL, NEARLY PINCHOUT WITHIN 200 YARDS. | | |
| CORWIN FORMATION (NONE-MARINE) | DELTA PLAIN | OVERBANK-FLOOD BASIN | SWAMPS AND MARSH | 5'–60' | 0%–15% | BEDS LESS THAN 2.0'–SMALL SPLAYS | NOT DETERMINED. | | |
| CORWIN FORMATION (NONE-MARINE) | DELTA PLAIN | TIDAL FLAT | TIDAL CREEKS AND CHANNELS | 1'–20' | 100% | 1–20' | MOST EXPOSURES SHOW LATERAL DECREASE IN THICKNESS OR PINCHOUTS. PROBABLY 20–200 YDS. ACROSS. | 3.1% 0.0038 md. 1 SPL. | |
| CORWIN FORMATION (NONE-MARINE) | DELTA PLAIN | TIDAL FLAT | LOWER TO UPPER FLATS | 5'–20' | 15%–40% | GENERALLY LESS THAN 2.5' EXCLUDING CHANNELS | NOT DETERMINED. | | |
| KUKPOWRUK FORMATION (MARINE) | DELTA PLAIN | TIDAL FLAT | MARSH | 5'–70'+ | 0–20% | GENERALLY LESS THAN 2.0' THICK | NOT DETERMINED. | | |
| KUKPOWRUK FORMATION (MARINE) | DELTA PLAIN | | INTERDISTRIBUTARY BAY | UNCERTAIN, PROBABLY 10'–50' | 5%–20% | GENERALLY LESS THAN 20' THICK BEDS | NOT DETERMINED. PROBABLY WIDESPREAD. | | |
| KUKPOWRUK FORMATION (MARINE) | DELTA FRONT | | TIDALLY INFLUENCED DISTRIBUTARY CHANNELS AND CHANNEL-MOUTH BARS | COMMONLY 40'–80', 100' MAXIMUM | 95%–100% | INDIVIDUAL SEQUENCES COMMONLY 10–25' COMPOSITES 40'–100' | WIDESPREAD-SEVERAL SS LATERALLY TRACED FOR 7.5 MI. UNTIL COVERED. AIR PHOTOS SHOW SHEET SS IN LOWER Knk. | 7.58% 0.486 md. RANGE: 2.5–15.7% RANGE: 0–3.49 md. 64 SPLS. | |
| KUKPOWRUK FORMATION (MARINE) | DELTA FRONT | | HIGH-ENERGY SHOREFACE | 12'–30' | 80%–95% | GENERALLY 10'–20' UNINTERRUPTED SANDSTONE | NOT DETERMINED, PROBABLY WIDESPREAD. SIMILAR TO CHANNEL MOUTH BAR SS. | 8.03% 0.070 md. RANGE: 7.3–9.1% RANGE: 0.02–0.20 md. 4 SPLS. | |
| KUKPOWRUK FORMATION (MARINE) | DELTA FRONT | | LOW-ENERGY SHOREFACE | 8.5'–17.0' | 60%–80% | THIN-BEDDED, 6'–17' COMPOSITE SANDSTONE | NOT DETERMINED. | 5.12% 0.029 md. RANGE: 1.7–7.6% RANGE: 0.0029–0.08 md. 5 SPLS. | |
| TOROK FORMATION | PRODELTA - OPEN MARINE SHELF | | PRODELTA | 25'–110'+ | 10%–35% | MOST BEDS LESS THAN 2.0', RARE BEDS TO 6.0' THICK SHALES SEPARATING SS. | NOT DETERMINED, EVEN, PERSISTENT THICKNESS IN OUTCROPS. | 5.53% 0.063 md. RANGE: 1.1–10.3% RANGE: 0–0.46 md. 13 SPLS. | |
| TOROK FORMATION | PRODELTA - OPEN MARINE SHELF | | MARINE SHELF | UNDETERMINED | 0–15% | GENERALLY LESS THAN 1.5' THICK | NOT DETERMINED, PROBABLY LATERALLY EXTENSIVE. | | |
| TOROK FM. / FORTRESS MT. TONGUE / TING SAND MEMBER | DEEP SEA FAN | | LOWER FAN-INTERCHANNEL OR DISTAL FAN TURBIDITES | 1.0'–10.0' | 40% | 1.0'–25.0' | NOT DETERMINED, PROBABLY EXTENSIVE. | 7.15% 0.05 md. RANGE: 5.8–10.5% RANGE: 0.0029–0.179 md. 4 SPLS. | |
| TOROK FM. / FORTRESS MT. TONGUE / TING SAND MEMBER | DEEP SEA FAN | | LOWER FAN-CHANNELIZED DISTAL HIGH DENSITY GRAVITY FLOW SANDSTONES | 5.0'–25.0' | 40% | 5.0'–25.0' | NOT DETERMINED, PROBABLY LIMITED. | 10.7% 0.338 md. RANGE: 10.2–11.2% RANGE: 0.036–0.88 md. 3 SPLS. | |
| TOROK FM. / FORTRESS MT. TONGUE | DEEP SEA FAN | | UPPER FAN-CHANNELIZED PROXIMAL HIGH DENSITY GRAVITY FLOW CONGLOMERATE AND SANDSTONE | 5.0'–200.0' | 70% | 5.0'–200.0' | NOT DETERMINED, PROBABLY LIMITED. | 4.5% 1.00 md. 1 SPL. | |

| Facies | Mean Grain Size and Sorting | Vertical Textural Trends | Sedimentary Structures and Stratification (A - ABUNDANT, C - COMMON, R - RARE) | | Fossils/Degree of Bioturbation | Contact Relations |
|---|---|---|---|---|---|---|
| POINT BAR | COARSE TO V.F. SS, GEN. MED. GRAINED AT BASE, FINE AT TOP MOD. TO WELL SORTED. | CONGLOMERATIC PEBBLY SANDSTONE (LAG PEBBLES) AT BASE, FINES REGULARLY UPWARD INTO SILTSTONE | A - LARGE-SCALE (1'-6') TABULAR + TROUGH CROSS-STRAT; A - CLIMBING RIPPLES & SMALL-SCALE TROUGH X-STRAT.; C - LATERAL ACCRETION SURF.; C - HORIZ. LAMINATION; C - SMALL-SCALE TABULAR X-STRAT.; C - CONGLOMERATIC LAGS + SCOUR FILLINGS; R - DEFORMED BEDDINGS | | ABUNDANT PLANT DEBRIS AND LARGE LOGS UP TO 6' IN LENGTH AT BASES OF CHANNELS. | IRREGULAR, EROSIONAL BASE WITH CONGLOMERATIC LENSES–1'–6' TOTAL RELIEF. TRANSITIONAL AT TOP INTO OVERLYING SILTSTONE. |
| ABANDONED CHANNEL FILL | SILTSTONE TO SILTY FINE SS, POORLY SORTED | NO REGULAR TREND | A - ROOT MOTTLED; C - CLIMBING RIPPLES; C - ACCRETIONARY BEDDING; C - SOFT-SEDIMENT LOADING AND DEFORMATION; R-C - IRONSTONE BEDS & CONCRETIONS; C - COALY SEAMS + BEDS | | ABUNDANT PLANT DEBRIS, AND IN-PLACE ROOTS AND STEMS. RARE TRACKS AND TRAILS, BURROWS. | EROSIONAL BASE, SOME CHANNELS FILLED FROM SIDES BY ACCRETING FORESETS. TOP COMMONLY ERODED BY OVERLYING CHANNEL. |
| CREVASSE SPLAY | SILTY V. FINE SS–FINE SS. POORLY SORTED | MANY SS. SHOW SLIGHT UPWARD COARSENING AND INCREASE IN BED THICKNESS. NO REGULAR TREND IN OTHERS. | A - CLIMBING RIPPLES; A - ROOTED BEDS; C - HORIZ. LAMINATION; R - LIGHTLY BURROWED TOPS OF BEDS; R - WAVE RIPPLES; R - IRONSTONE NODULES; R - TABULAR X-STRAT. (0.5'-1.5' THICK) | | ABUNDANT PLANT DEBRIS, IN-PLACE ROOTS AND STEMS. TOPS OF SOME SPLAY SANDSTONES ARE HEAVILY BIOTURBATED-MOSTLY HORIZONTAL BURROWS. | TRANSITIONAL OR SHARP BASE. GENERALLY GRADATIONAL OVER A FEW INCHES W/UNDERLYING SILTSTONE. TRANSITIONAL TOPS TO BEDS AND UNIT. |
| LEVEE | SILTSTONE TO F. SS. POOR TO MOD. SORTED | NO REGULAR TREND. FINER GRAINED AND THINNER BEDDED AWAY FROM CHANNELS. | A - ROOT MOTTLED; C - CLIMBING RIPPLES; C - CONTORTED LAMINATION | | ABUNDANT PLANT DEBRIS, IN-PLACE ROOTS AND STEMS. | TRANSITIONAL TOP AND BASE. |
| SWAMPS AND MARSH | SILTY SHALE TO SANDY SILTSTONE | A FEW SHOW SLIGHT UPWARD COARSENING–MOST HAVE NO REGULAR TREND. | A - ROOT MOTTLED; A - COAL SEAMS, SHALY COAL; C - IRONSTONE BEDS + CONCRETIONS; LITTLE OR NO STRAT. EXCEPT FOR WELL LAM. POSSIBLE LAKE DEPOSITS (RARE) | | ABUNDANT PLANT DEBRIS, IN-PLACE ROOTS AND STEMS. WOODY MATERIAL COMMON. | TRANSITIONAL TOP AND BASE. |
| TIDAL CREEKS AND CHANNELS | V.F. TO MED. SS GEN. FINE SS. MOD. TO WELL SORTED | SLIGHTLY FINER UPWARD | A - MED. SCALE TROUGH X-STRAT. (0.5-2.0' THICK); A - COMBINED FLOW RIPPLES; C - SHALE PEBBLE LAGS AT BASE OF CHANNEL; C - SOLE MARKS LOAD CASTS; C - BIMODAL X-STRAT.; R - FLASER BEDDING | | COMMON FRAGMENTED PLANT MATERIAL. RARE CLAMS. RARE VERTICAL BURROWS AT TOP OF SANDSTONES. | EROSIONAL BASE, LESS THAN 3' LOCAL RELIEF. TRANSITIONAL TOP INTO SANDY SILTSTONE. |
| LOWER TO UPPER FLATS | SILTSTONE TO FINE SS. POOR TO MOD SORTED | UPWARD FINING TREND FROM SANDIER LOWER FLATS + TIDAL CHANNELS TO SHALY UPPER PART | A - FLASER BEDDING; A - WAVE, COMBINED FLOW, & INTERFERENCE RIPPLES; C - BIOTURBATED MUD; C - LOW ANGLE X-STRAT (< 1' THICK); R - ROOTS | | MODERATE PLANT MATERIAL. LIGHTLY TO HEAVILY BURROWED. MOSTLY BEDDING PLANE BURROWS, TRACKS + TRAILS. RARE CLAMS. | TRANSITIONAL TOP INTO SHALE, BASE TRANSITIONAL WITH UNDERLYING SHALE. |
| MARSH | SILTY SHALE TO SANDY SILTSTONE | NO REGULAR VERTICAL TREND. | A - COAL BEDS (< 4' THICK); A - ROOTS; C - IRONSTONE CONCRETIONS; C - CLIMBING RIPPLES | | ABUNDANT PLANT DEBRIS, IN PLACE ROOTS AND STEMS. COMMON TRACKS AND TRAILS. | TRANSITIONAL BASE AND TOP INTO SILTY SHALE. |
| INTERDISTRIBUTARY BAY | SILTY SHALE TO V. FINE SS. | NO REGULAR VERTICAL TREND | R - WAVE RIPPLES | | HEAVILY BIOTURBATED. COMMON CLAMS. | TRANSITIONAL BASE AND TOP. |
| TIDALLY INFLUENCED DISTRIBUTARY CHANNELS AND CHANNEL-MOUTH BARS | V.F. SS. TO MED. SS GEN. MED. SS AT BASE, FINE AT TOP. MOD. TO WELL SORTED | GENERALLY FINE-UPWARD WITH CONGLOMERATIC ZONES AT BASE. TOPS OF MANY UNITS ERODED BY OVERLYING UNIT OR NOT EXPOSED. | A - LARGE SCALE (1-5') TROUGH X-STRAT; C - SMALL SCALE TROUGH X-STRAT. + CLIMB. RIPPLES; C - LARGE SCALE TABULAR X-STRAT.; C - WAVE + CONTORTED FLOW RIPPLE; C - SCOUR TRILL STRUCTURES; C - HORIZ. LAMINATION; C - LOAD MARKS AT BASE; R - CLAY DRAPES | | RARE VERTICAL BURROWS, RARE CLAMS. RARE TO COMMON PLANT MATERIAL. BEDDING PLANE TRACES RARE TO COMMON. | EROSIONAL BASE, COMMONLY CUT INTO BAY OR PRO-DELTA MUDS. UP TO 8' LOCAL RELIEF. TOP GENERALLY ERODED, PROBABLY TRANSITIONAL INTO SHALE. |
| HIGH-ENERGY SHOREFACE | FINE TO MED. SS MOD. TO WELL SORTED | SLIGHT COARSENING UPWARD ALTHOUGH NOT WELL EXPOSED. GENERALLY ONLY UPPER PART EXPOSED | A - LOW-ANGLE TROUGH X-STRAT. (0.5-2.0' THICK); A - HORIZ. LAMINATION; C - WAVE RIPPLES; R - WEDGE SETS OF LOW ANGLE FORESETS | | RARE CLAMS. HEAVILY BIOTURBATED IN LOWER PART-VERTICAL WALLED "OPHIOMORPHA" BURROWS. BEDDING PLANE BURROWS RARE NEAR TOP. RARE PLANT MATERIAL. | BASE NOT WELL EXPOSED. TOP GENERALLY TRANSITIONAL INTO SILTSTONE. |
| LOW-ENERGY SHOREFACE | SILTSTONE TO F. SS. POOR TO MOD. SORTED | WELL DEVELOPED UPWARD COARSENING AND INCREASE IN SORTING. GRADES FROM SILTSTONE INTO FINE SS. | A - HORIZ. LAMINATED ORGANIC RICH LAYERS & V.F. SAND; A - WAVE INTERFERENCE RIPPLES; R - LOW-ANGLE TROUGH X-LAMINATION | | HEAVILY BIOTURBATED AT BASE, VERTICAL "OPHIOMORPHA" BURROWS, ABUNDANT PLANT MATERIAL. RARE CLAMS. | BASE TRANSITIONAL INTO UNDERLYING SILTY SHALE. BEDS THICKEN UPWARD. TOP TRANSITIONAL INTO FLASER BEDDING AND SILTSTONE. |
| PRODELTA | SILTY SHALE TO V.F. SS. POOR TO MOD. SORTED | INDIVIDUAL BEDS FINE UPWARD. PRODELTA SEQUENCE IS SANDIER, THICKER SS BEDS NEAR TOP | A - LOAD MARKS, SOLE MARKS, E.G. FLUTE CASTS, GROOVE CASTS; A - BEDDING PLANE BURROWS; C - GRADED BEDS; C - HORIZ. LAMINATION; C - MASSIVE BEDDING; C - CLIMBING RIPPLES; R - HUMMORKY BEDDING; R - X-LAMINATION (< 1.5') | | COMMON FINE PLANT MATERIAL. ABUNDANT TRACKS + TRAILS ON BEDDING PLANES. | BASE TRANSITIONAL WITH UNDERLYING SHELF MUDS. INDIVIDUAL SS BEDS HAVE SHARP EROSIVE BASES + TRANSITIONAL UPPER CONTACTS. PRODELTA FACIES BECOMES THICKER BEDDED + SANDIER UPWARD INTO DISTAL BAR. |
| MARINE SHELF | CLAY SHALE TO SILTSTONE | NO REGULAR VERTICAL TREND. | A - BIOTURBATION; C - THIN GRADED SANDSTONE BEDS; C - WAVE RIPPLES | | HEAVILY BIOTURBATED, VERTICAL BURROWS, AND HORIZONTAL BURROWS. COMMON PELECYPODS. | TRANSITIONAL UPPER CONTACT; LOWER CONTACT NOT OBSERVED. |
| LOWER FAN-INTERCHANNEL OR DISTAL FAN TURBIDITES | FINE TO V. FINE GRAINED SANDSTONE (QUARTZ WACKE) POORLY SORTED | FINE-GRAINED SS AT BASE FINING SYSTEMATICALLY UPWARD AND TRANSITIONAL INTO OVERLYING SHALE AND SILTSTONE. | A - LOAD MARKS, SOLE MARKS, E.G. FLUTE CASTS, GROOVE CASTS, PARTING LIN.; A - HORIZ. LAMINATIONS; A - CONVOLUTED LAMINATIONS; C - MASSIVE BEDDING; C - CLIMBING RIPPLES; R - RIP-UPS | | POSSIBLE RARE BURROWS. | INDIVIDUAL SANDS HAVE SHARP EROSIVE BASES SCOURED INTO MUD. UPPER CONTACTS TRANSITIONAL INTO OVERLYING MUD. |
| LOWER FAN-CHANNELIZED DISTAL HIGH DENSITY GRAVITY FLOW SANDSTONES | FINE TO MED. GRAINED SANDSTONE (QUARTZ ARENITE) WELL-SORTED | MASSIVE–NO REGULAR VERTICAL TREND. | A - SHARP UPPER AND LOWER CONTACTS; A - MASSIVE; C - HORIZ. OR CONVOLUTED LAMINATIONS; C - DISH STRUCTURES, FLUID ESCAPE PILLARS; R - TROUGH, X-LAMINATIONS; R - RIPPLED TOPS | | NO FOSSILS. | INDIVIDUAL SANDS HAVE SHARP UPPER AND LOWER CONTACTS. |
| UPPER FAN-CHANNELIZED PROXIMAL HIGH DENSITY GRAVITY FLOW CONGLOMERATE AND SANDSTONE | POORLY SORTED PEBBLE TO COBBLE POLYMICTIC CONGLOMERATE W/LENSES OF PEBBLY SANDSTONE (LITHARENITE) | LOCAL NORMAL AND REVERSE GRADING–NO REGULAR VERTICAL TREND–GENERALLY. | A - MASSIVE BEDDING; C - HORIZ. SS LENSES W/ HORIZ. LAMINATIONS; R - TROUGH X-STRAT.; R - COALIFIED PLANT FRAGS.; R - CONTORTED BEDDING. | | NO FOSSILS. RARE COALIFIED PLANT DEBRIS. | INDIVIDUAL SANDSTONE OR CONGLOMERATE BEDS HAVE SHARP UPPER AND LOWER CONTACTS. |

| Facies | Vertical Sequences and Coments | | Examples from Measured Sections and Photographic Keys |
|---|---|---|---|
| POINT BAR | UPPER POINT BAR: ROOTED SILTSTONE, CLIMBING RIPPLES (TYPE A). LOWER POINT BAR + CHANNEL LAG: SMALL-SCALE TABULAR CROSS-STRAT.; LARGE-SCALE TABULAR AND TROUGH CROSS-STRAT.; MINOR SCOUR + FILL BEDDING; LATERAL ACCRETION BEDDING; CONGLOMERATIC LAG; ERODED BASE | COMMONLY SEVERAL VERTICALLY SUPERIMPOSED POINT BAR SEQUENCES WITH PARTIAL EROSION OF UPPER PARTS OR SEPARATION BY PARTIALLY ABANDONED CHANNEL FILLS MARKED BY CLAY-RICH UNITS AND IRONSTONE BEDS. | W–26, UPPER PART, E.G. 8940, 9300, 9540, 9800; COKE BASIN–CORWIN FM.–T7S, R47W, SEC. 19–UNMEASURED CUT. W–16, 2340; W–15, 2300, 2430, 2450. SEE PHOTOGRAPHS: (R5/F6), (R5/F10,11,12), (R6/F19,20,21,22,23,24,25), (R7/F16), (R3/F1,2), (R4/F33), (R4/F21). |
| ABANDONED CHANNEL FILL | ABANDONED CHANNEL FILL: COAL; CLIMBING RIPPLES; IRONSTONE CONCRETIONS + BEDS; HEAVILY ROOTED; IRREGULARLY BEDDED SILTSTONE; LATERAL ACCRETION BEDDING; ERODED BASE | HEAVILY ROOTED AND ABUNDANT IRONSTONE CONCRETIONS AND BEDS. COMMONLY ABOVE OR SEPARATE POINT BAR SEQUENCES. LATERAL ACCRETION RESULTS FROM SIDE FILLING OF SOME ABANDONED CHANNELS BY CREVASSE SPLAYS. | W–26, 9700', 9740' COKE BASIN–CORWIN FM. T7S, R47W, SEC. 19. W–24, 1730', W–16, 4490'. SEE PHOTOGRAPHS: (R5/F9), (R5/F10,11,12), (R6/F19,20,21,22,23,24,25). |
| CREVASSE SPLAY | CREVASSE SPLAYS: ROOTS + BURROWS; CLIMBING RIPPLES; SLIGHT PROGRADATIONAL SEQ.; ABRUPT LATERAL PINCH-OUT OF BEDS.; NO VERTICAL TREND IN SED. STRUCTURES. | SPLAY SANDSTONES ARE SOMETIMES BURROWED ON TOP, MORE COMMONLY ROOTED. CREVASSE SPLAYS INTO SHALLOW BAYS AND MARGINAL SWAMPS. | W–15, 2140', 980, 1180. W–25, 209', W–16, 1650', 1720', 2580–2630', 1280–1290'. SEE PHOTOGRAPHS: (R4/F36), (R4/F35), (R3/F34), (R4/F9,10), (R6/F31). |
| LEVEE | NATURAL LEVEES: ROOTS; CONTORTED LAMINATION; CLIMBING RIPPLES + ROOT MOTTLED; THIN-BEDDED BEDS IRREGULAR & THICKEN UNIDIRECTIONALLY | DIFFICULT TO DISTINGUISH FROM SPLAY SS, UNLESS RELATIONSHIP TO CHANNEL CAN BE OBSERVED. CONTORTED LAMINATION COMMON. | ONLY DEFINITE LEVEE IDENTIFIED AT COKE BASIN CUT–T7S, R47W, SEC. 19. OTHER POSSIBLE LEVEE–LIKE SILTSTONES + SANDSTONES NOTED AT W–26 8420, 8350 + OTHER LOCATIONS. SEE PHOTOGRAPHS: (R5/F28), (R5/F29), (R6/F19,20,21,22,23,24,25). |
| SWAMPS AND MARSH | SWAMP AND MARSH: COAL-LIGNITE-BEDS LESS THAN 2'; MASSIVE NONSTRAT. SILTSTONE; HEAVY-ROOT MOTTLING + ABUND. PLANT DEBRIS; IRONSTONE CONCRETIONS; COALY SEAMS | PROBABLY INCLUDES FRESH TO SALT WATER MARSH AND SWAMP DEPOSITS. NO ATTEMPT WAS MADE TO DISTINGUISH BETWEEN THE TYPES. | W–26, 5610–5650', 10,220–10,310', W–25, 175–200', W–24, 2430', 2475'. W–15, 2640–2660', W–16, 4430–4470'. |
| TIDAL CREEKS AND CHANNELS | STACKED TIDAL FLAT SEQUENCES. MARSH / U.F. / M.F. / L.F. + TIDAL CREEKS: COAL; COAL; FLASER BEDDING; WAVE + INTERFERENCE RIPPLES; LOW ANGLE X-STRAT.; SHALE-PEBBLE LAG W/CLAMS | STACKED TIDAL FLAT SEQUENCES–ABUNDANT SMALL TIDAL CREEKS – SS LENSES IN LOWER PARTS. FLASER BEDDING AND INTERFERENCE RIPPLES IN UPPER PARTS COMMONLY CAPPED BY ROOTED ZONE OR SALT MARSH DEPOSITS. | TIDAL FLAT SEQUENCES WELL EXPOSED AT W–16, S. FLANK SNOWBANK ANTICLINE ON KUKPOWRUK RIVER, W–13, W–15, E.G., W–16, 1495, 1560, 2290, 1930; W–13, 0–10, 60–70; W–15, 710, 1140, 1970, 2280. WELL DEVELOPED COALS IN TIDAL MARSHES ON S. FLANK SNOWBANK–KUKPOWRUK R. SEE PHOTOGRAPHS: (R2/F12), (R2/F13), (R2/F23), (R4/F28), (R6/F34), (R6/F33), (R6/F35), (R7/F9), (R7/F10). |
| LOWER TO UPPER FLATS | MARSH / V.F. / M.F. / L.F. + TIDAL CREEKS: ROOTS; COAL; FLASER BEDDING; RIPPLED SANDSTONE; LADDERBACK INTERFERENCE RIPPLES; BIMODAL CROSS-BEDS; EROSIONAL BASE | | |
| MARSH | MARSH / U.F. / M.F. / L.F. + TIDAL FLATS: ROOTS + CLIMBING RIPPLES; ABUNDANT INTERFERENCE RIPPLES | | |
| INTERDISTRIBUTARY BAY | INTER-DIST. BAY: THIN RIPPLED SS BEDS; COMMON PELECYPODS; HEAVILY BIOTURBATED | BAY FACIES RECOGNIZED BY HEAVY BIOTURBATION AND ABUNDANCE OF PELECYPODS. | W–16,750', W–15,1940, 600', W–18,300–320'. W–26 SHEET 1 |
| TIDALLY INFLUENCED DISTRIBUTARY CHANNELS AND CHANNEL-MOUTH BARS | TIDALLY INFLUENCED DISTRIBUTARY. PART. ABAND.: RARE BURROWS–BED. PLANE TYPE; THIN BEDDED + LAMIMATED; SMALL-SCALE TROUGH X-STRAT.; COMBINED FLOW RIPPLES. ACTIVE CHANNEL: SMALL-SCALE TABULAR X-STRAT.; LARGE SCALE TROUGH X-STRAT.; SCOUR + FILL BEDDING; CONGLOMERATIC LAGS AT BASES OF SCOURS; EROSIONAL BASE; MED. SCALE TROUGH X-STRAT. | TWO MAJOR FACIES: A) THIN-BEDDED, WELL LAMINATED WITH SMALL-SCALE X-BEDS, WAVE RIPPLES, AND HORIZ. LAM. B) THICK-BEDDED, LARGE-SCALE TROUGH AND TABULAR X-STRAT. COMMON SCOUR SURFACES + CHANNEL FILL LINED BY PEBBLES. RARE VERTICAL BURROWS. PROBABLY REPRESENT–ESTUARINE CONDITIONS AT MOUTHS OF DISTRIBUTARY CHANNELS. MIGRATION OF TIDALLY INFLUENCED CHANNELS CAUSES UPWARD FINING SEQUENCES. BIMODAL PALEOCURRENTS, CLAMS, WAVE-RIPPLES, BIOTURBATION AND PROXIMITY TO MARINE FACIES SUGGEST MARINE INFLUENCE. | 1. DISTRIBUTARY CHANNEL SAND: MOST SECTIONS IN Knk SHOW THREE TYPE SS. E.G. W–17A 0–70', 17–C, W–22 215', W–21 1750, 2260', W–18 450, W–15 2010', W–13 130'. SEE PHOTOGRAPHS: (R2/F8), (R2/F17), (R2/F25,29,30), (R2/F34), (R4/F11), (R4/F12,13,14), (R4/F21), (R4/F23,24,25,26,27), (R4/F36), (R5/F26,27), (R7/F9), (R7/F13), (R7/F14), (R7/F15), (R7/F26) |
| HIGH-ENERGY SHOREFACE | VERTICAL BURROWS–RARE; SCOUR + FILL BEDDING; LARGE-SCALE TROUGH X-STRAT. + MINOR TABULAR SETS; LOW ANGLE FORESETS; WAVE RIPPLES. HIGH ENERGY SHOREFACE: NOT WIDELY DESC. FEASIBLE SHORE FACE, SS PERIPHERAL TO MAJOR DISTRIBUTARY CHANNEL. | | 2. HIGH ENERGY SHOREFACE: W–26: 0', W–15: 1990', W–14: 170'. PLUS OTHER OCCURRENCES IN THICK CHANNEL MOUTH BAR SS. THAT ARE PROBABLY UNSCOURED REMNANTS OF SHOREFACE SANDSTONES. SEE PHOTOGRAPHS: (R2/F9), (R2/F10), (R6/F26), (R6/F27) |
| LOW-ENERGY SHOREFACE | THIN-BEDDED HORIZONTAL LAMINATED + RIPPLED; LARGE-SCALE TROUGH AND TABULAR X–STRAT. LOW ENERGY SHOREFACE: FINE-GRAINED, MORE POORLY SORTED THAN HIGH ENERGY SHOREFACE. MOSTLY SILTY V.F. SS. ORGANIC RICH BEDS. HORIZ. LAM. | | 3. LOW ENERGY SHOREFACE: W–26: 4950', W–22: SHEET 4 (RLS–165), W–16: 805', 3175' (COVERED). SEE PHOTOGRAPHS: (R4/F28). |
| PRODELTA | DISTAL DELTA FRONT / PRO DELTA: LOW ANGLE TROUGHS + WAVE RIPPLES; SOFT SEDI. DEFORMATION.; BALL + PILLOW BEDS; HUMMOCKY STRAT.; ERODED BASES ABUNDANT; SOLE MARKS, SCOUR CASTS, FLUTE CASTS, LOAD FEATURES,; GRADED BEDS, CLIMBING RIPPLES; WIDE ASSORTMENT OF HORIZ. BURROWS | DISTAL BARS AND STORM DEPOSITS (HUMMOCKY STRAT.) DOWNSLOPE MASS-SEDIMENT MOVEMENT (BALL AND PILLOW) AND DENSITY FLOWS DURING FLOODING PRODUCED GRADED THIN SANDSTONE BEDS WITH ABUNDANT SOLE FEATURES. EXTENSIVE ARRAY OF TRACE FOSSILS AND ABUNDANT PELECYPODS. PRODELTA FACIES IS POORLY DEVELOPED, AND THIN–RARE BEDS SHOW STRUCTURES SUGGESTING MOSTLY BAY-TYPE SHALLOW WATER DEPOSITION. | DISTAL BAR PRODELTA: W–15: 5490'–6000', W–22: 140–205', SHEET 4 ~ KLS 163–164, W–18: 380–440'. COMMONLY INDISTINGUISHABLE FROM BAY AND OPEN MARINE. SEE PHOTOGRAPHS: (R2/F31), (R2/F32), (R2/F33), (R3/F5), (R4/F28), (R4/F31). |
| MARINE SHELF | OPEN MARINE: HEAVY BIOTURBATION; THIN SILTSTONE BEDS | PRODELTA AND SHELF FACIES MOSTLY EXPOSED IN TOROK FORMATION. ABUNDANT PELECYPODS AND BIOTURBATION WITH THIN, PROBABLY DISTAL DENSITY FLOWBEDS AND STORM DEPOSITED SS. LITTLE DETAILED EXAMINATION OF THIS FACIES IN THIS STUDY. | MOSTLY TOROK SHALE SECTIONS AND COVERED SHALE IN KUKPOWRUK FM. SEE PHOTOGRAPHS: (R4/F4), (R4/F6). |
| LOWER FAN-INTERCHANNEL OR DISTAL FAN TURBIDITES | DISTAL FAN INTERCHANNEL: CLIMBING RIPPLES; HORIZONTAL LAM.; CONTORTED LAM.; SOLE MARKS; HORIZONTAL LAM.; CONTORTED LAM | NORMALLY-GRADED TURBIDITES. CONVOLUTE LAMINATION, HORIZONTAL LAMINATION, PARTING LINEATIONS DOMINANT. GENERALLY CONVOLUTE LAM. AT BASE FOLLOWED UPWARD BY HORIZONTAL LAM., CLIMBING RIPPLES NEAR TOPS OF A FEW UNITS. ABUNDANT SOLE MARKS, LOAD CASTS, FLUTE CASTS. INTERPRETATION: TURBIDITES "BOUMA B, C, D, E UNITS. PROBABLY ASSOCIATED WITH OVERBANKING OF SUBMARINE FAN CHANNELS–SHEET-LIKE SANDSTONE. | SEE SECTION W–11, INTERVAL 180'–275'. SEE PHOTOGRAPHS: (R1/F22), (R1/F23), (R2/F2). |
| LOWER FAN-CHANNELIZED DISTAL HIGH DENSITY GRAVITY FLOW SANDSTONES | DISTAL FAN CHANNEL: RIPPLES; DISH STRUCTURES; CONTORTED LAM. RELATIONSHIP UNKNOWN | WELL-SORTED QUARTZ ARENITE. SHARP TOP AND BASE. RARELY SHOWS SUGGESTION OF CHANNELING. MASSIVE TO THICK-BEDDED. DOMINANT FEATURE IS CONTORTED, SOFT-SEDIMENT DEFORMATION. NO VERTICAL CHANGE IN GRAIN-SIZE. DISH STRUCTURES AND PROBABLE FLUID ESCAPE PILLARS NOTED. FAINT HORIZONTAL LAMINAE AT TOPS. SOMETIMES RIPPLED AT TOPS. INTERPRETATION: HIGH-DENSITY SEDIMENT GRAVITY FLOW, I.E., FLUIDIZED, LIQUIFIED OR GRAIN FLOW, SEDIMENT EMPLACED RAPIDLY AS SLURRY WITH LIQUIFICATION AND HYDROPLASTIC DEFORMATION. PROBABLY CHANNELIZED AND ASSOCIATED WITH SUBMARINE FAN. | SEE SECTION W–11, INTERVAL 275'–330'. W–12, INTERVAL 310'–380'. SEE PHOTOGRAPHS: (R1/F22), (R1/F23), (R2/F2). |
| UPPER FAN-CHANNELIZED PROXIMAL HIGH DENSITY GRAVITY FLOW CONGLOMERATE AND SANDSTONE | PROXIMAL FAN CHANNEL: REVERSE GRADING; SANDSTONE LENSES; REVERSE GRADING; NORMAL GRADING | COARSE-GRAINED (CLASTS UP TO 9") MASSIVE CONGLOMERATE, CLAST-SUPPORTED AND MATRIX-SUPPORTED, CONTAINING CLASTS OF MAFIC IGNEOUS ROCK, LIMESTONE, CHERT (WHITE & BLACK) SANDSTONE. TOP AND BOTTOM CONTACTS SHARP, WITH SOME SOLE MARKS (FLUTE CASTS) ON BOTTOMS. MORE MASSIVE, THICKER BEDS EXHIBIT BOTH NORMAL & REVERSE GRADING. THINNER BEDS (TURBIDITES?) EXHIBIT NORMAL GRADING W/COBBLES UP TO 8" IN DIAMETER AT BASE. THIN SANDSTONE LENSES WITHIN MASSIVE CONGLOMERATE EXHIBIT HORIZONTAL OR TROUGH CROSS-LAMINATION. THIN SANDS INTERBEDDED W/SHALE MAY CONTAIN CONVOLUTED BEDDING. | SEE SECTION W–12, INTERVAL 0–290'. SEE PHOTOGRAPHS: (R2/F4), (R2/F5), (R2/F6). |



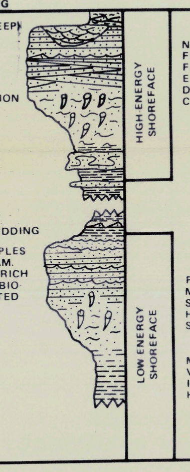




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**CHART SUMMARIZING ENVIRONMENTAL INTERPRETATION OF FORTRESS MTN., TOROK, KUKPOWRUK, AND CORWIN FORMATIONS**

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