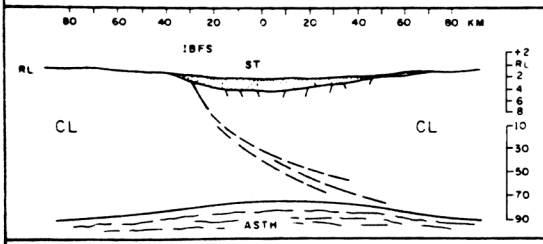
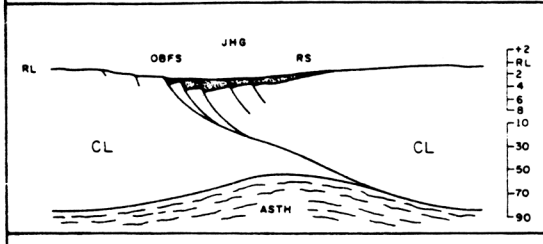
POSSIBLE STAGES IN THE EVOLUTION OF RIFTS



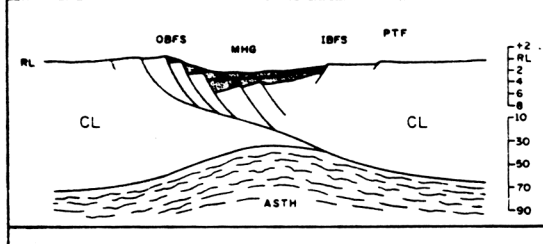
STAGE 1 STRETCH TROUGH (ST)

INITIAL STRETCHING AND THINNING OF CL, CREATING RELATIVELY BROAD SURFACE DEPRESSION. UPPERMOST CRUST MAY SHATTER, BUT FAULT THROWS GENERALLY BELOW RESOLUTION LIMITS OF SEISMICS. TYPICAL AMOUNT OF SUBSIDENCE IS 10 TO 15 KM. SEDIMENT INFILL DOMINATED BY FLUVIAL OR EOLIAN SANDS SHOWING MUCH REWORKING. SYSTEM WILL APPEAR TRANSGRESSIVE WITH VARIABLE AND COMPLICATED INPUT-PATTERN.
COMPARE TO STAGE 1 OF KAZMIN (1980a).



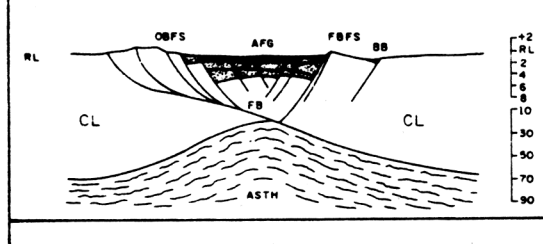
STAGE 2 JUVENILE HALF-GRABEN (JHG)

DEVELOPMENT OF ASYMMETRIC GRABEN COMPOSED OF FAULT BLOCKS THAT TILT MAINLY IN THE SAME DIRECTION. OBFS DIVIDES REGION OF SHOULDER UPLIFT FROM REGION OF CONTINUED SUBSIDENCE, BUT ACTUAL SUBSIDENCE MORE OR LESS EQUALLY DISTRIBUTED AMONG FAULTS THAT DEFINE TILTED BLOCKS. TYPICAL NUMBER OF ACTIVE BLOCKS RANGE FROM 3 TO 6, WITH TYPICAL WIDTH OF 10 KM. REGION OF ACTIVE SUBSIDENCE GENERALLY NARROWER THAN WIDTH OF ST. STRATIGRAPHY CONTROLLED BY WEDGE-BLOCK STYLE OF DEPOSITION OF FLUVIAL CLASTICS, WHICH CAN ENTER FROM EITHER SIDE OF HALF-GRABEN. SEDIMENT LITHOLOGY DEPENDENT ON POSITION WITHIN WEDGE-BLOCK AND DISTANCE FROM SOURCE. ANGULAR UNCONFORMITY OFTEN DIVIDES STAGE 1 AND STAGE 2, SUGGESTING THAT ONSET OF BLOCK ROTATION IS RELATIVELY ABRUPT. ONSET OF STAGE 2 PROBABLY RELATES TO CREATION OF DETACHMENT ZONE THROUGH CL.



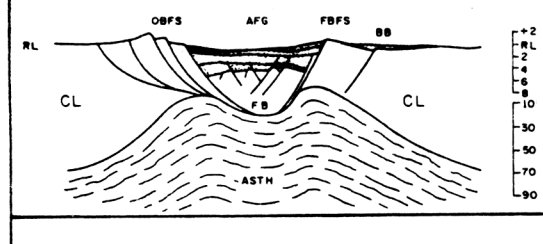
STAGE 3 MATURE HALF-GRABEN (MHG)

DEVELOPMENT OF STRONGLY ASYMMETRIC GRABEN WITH MOST OF SUBSIDENCE TAKEN UP ALONG OBFS. CONTINUED UPLIFT AND ROTATION OF SHOULDER USUALLY CREATES BACK-TILTED RIFT MOUNTAINS, RESULTING IN CESSATION OF SIGNIFICANT SEDIMENT INPUT FROM STEEP SIDE OF HALF-GRABEN. MOTIONS ALONG INTERNAL FAULTS SLOW OR CEASE, BUT OVERALL RATE OF SUBSIDENCE MAY ACCELERATE. SUBSIDENCE GENERALLY OUTPACES SEDIMENTATION, EXCEPT WHERE AXIAL DELTAS OCCUR WITH SWITCH FROM DISTRIBUTED TO LOCALIZED MASTER FAULT SYSTEMS. WEDGE-BLOCK STYLE OF DEPOSITION GIVES WAY TO CONSTRUCTION OF BROAD FANS ORIGINATING FROM RAMPING SIDE OF HALF-GRABEN.
COMPARE TO WERNICKE (1981).



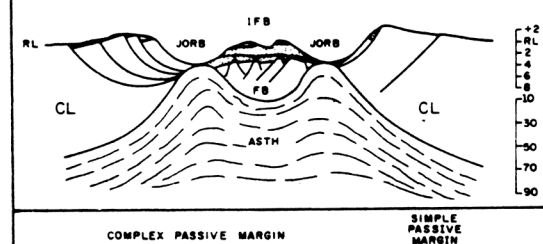
STAGE 4 FACING HALF-GRABEN

ACTIVATION OF FBFS CONCURRENT WITH RETARDATION OR CESSATION OF SUBSIDENCE ALONG OBFS. GEOMETRY EVENTUALLY PRODUCES APPARENT FULL-GRABEN WITH AXIAL HIGH, OR "HINGE ZONE". CENTRAL REGION MAY BECOME A FREE BLOCK. BACK-TILTED RIFT MOUNTAINS CAN DEVELOP ON BOTH SIDES OF BASIN, WHICH RESULTS IN CUTTING OFF FLUVIAL SEDIMENT SUPPLY AND CREATION OF DEEP, STARVED LAKES. ONSET OF ACTIVITY OF FBFS USUALLY MARKED BY ANGULAR UNCONFORMITY AND CREATION OF A NEW GENERATION OF FAULTS. SEDIMENTATION DOMINATED BY BIOGENIC RAIN AND LOCAL BORDER FAULT FANGLOMERATES.
COMPARE TO STAGE III OF LOWELL AND GENIK (1972).



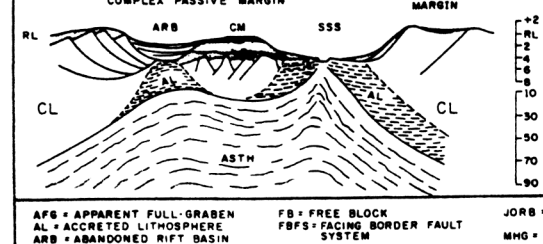
STAGE 5 SUBSIDENCE TEETER-TOTTER

ALTERNATION IN BOUNDARY FAULT ACTIVITY BETWEEN FBFS AND OBFS, POSSIBLY SEVERAL TIMES. ALTERNATIONS APPEAR TO BE RELATIVELY SUDDEN, RESULTING IN CREATION OF ANGULAR UNCONFORMITIES. ABANDONED SITE OF AFG MAY BE UPLIFTED AND ERODED, SOMETIMES EXTENSIVELY. OVERALL PATTERN IS A TEETER-TOTTER, ALBEIT WITH A COMPLICATED AND SPATIALLY CHANGING HINGE LINE. MOST OF SHALLOW PROCESSES EXPLICABLE IN TERMS OF FB TO RISING ASTH. IF ASTH RISES ALONG MAJOR DETACHMENTS, PLUME MAY SPLIT INTO EDDIES. DEPOSITIONAL PATTERNS DURING THIS STAGE MAINLY CONTINUATION OF PREVIOUS STAGE.



STAGE 6 JUVENILE OCEANIC RIFT BASIN (JORB)

DEVELOPMENT OF ONE OR MORE JORB. DRAWING SHOWS SITUATION OF SIMULTANEOUSLY ACTIVE JORB SEPARATED BY FB. CENTRAL BLOCK CAN BECOME COMPLETELY ISOLATED IF BOUNDED BY TRANSFORMS IN OTHER PLANE. IFB PROBABLY UPLIFTED RELATIVE TO LEVEL IN STAGE 4, RESULTING IN REDEFORMATION OF BLOCK AND EROSION AND REWORKING OF SEDIMENT PILE ON TOP OF FB.
COMPARE TO STAGE IV OF LOWELL AND GENIK (1972).



STAGE 7 SUCCESSFUL SPREADING SYSTEM (SSS)

CONTINUED OPENING OF ONE JORB AND EVENTUAL ABANDONMENT OF OTHER(S). ABANDONMENT CAN OCCUR AT ANY TIME FROM STAGE 4 ONWARD. SITUATION DEPICTED HERE SHOWS SMALL ARB, BUT FEATURES CAN BE LARGE, THICKLY SEDIMENTED BASINS UNDERLAIN BY BROAD ZONE OF AL. MECHANICALLY, FB BECOMES ATTACHED TO ONE OF PLATES BUT GEOPHYSICALLY AND PETROLOGICALLY IT WILL APPEAR AS A CONTINENTAL "MARSHMALLOW" RIDDLED WITH RIFT-TYPE STRUCTURES IF BOTH JORB REMAIN ACTIVE FOR LENGTHY PERIOD. IFB MAY BECOME A MICROCONTINENT.

AFG = APPARENT FULL-GRABEN
AL = ACCRETED LITHOSPHERE
ARB = ABANDONED RIFT BASIN
ASTH = ASTHENOSPHERE
BB = BACK BASIN
CL = CONTINENTAL LITHOSPHERE
CM = CONTINENTAL "MARSHMALLOW"
FB = FREE BLOCK
FBFS = FACING BORDER FAULT SYSTEM
IBFS = INCIPIENT BORDER FAULT SYSTEM
IFB = ISOLATED FREE BLOCK
JHG = JUVENILE HALF-GRABEN
JORB = JUVENILE OCEANIC RIFT BASIN
MHG = MATURE HALF-GRABEN
OBFS = ORIGINAL BORDER FAULT SYSTEM
PTF = PLATFORM
RL = REFERENCE LEVEL
RS = RAMPING SIDE OF HALF-GRABEN
SSS = SUCCESSFUL SPREADING SYSTEM
ST = STRETCH TROUGH