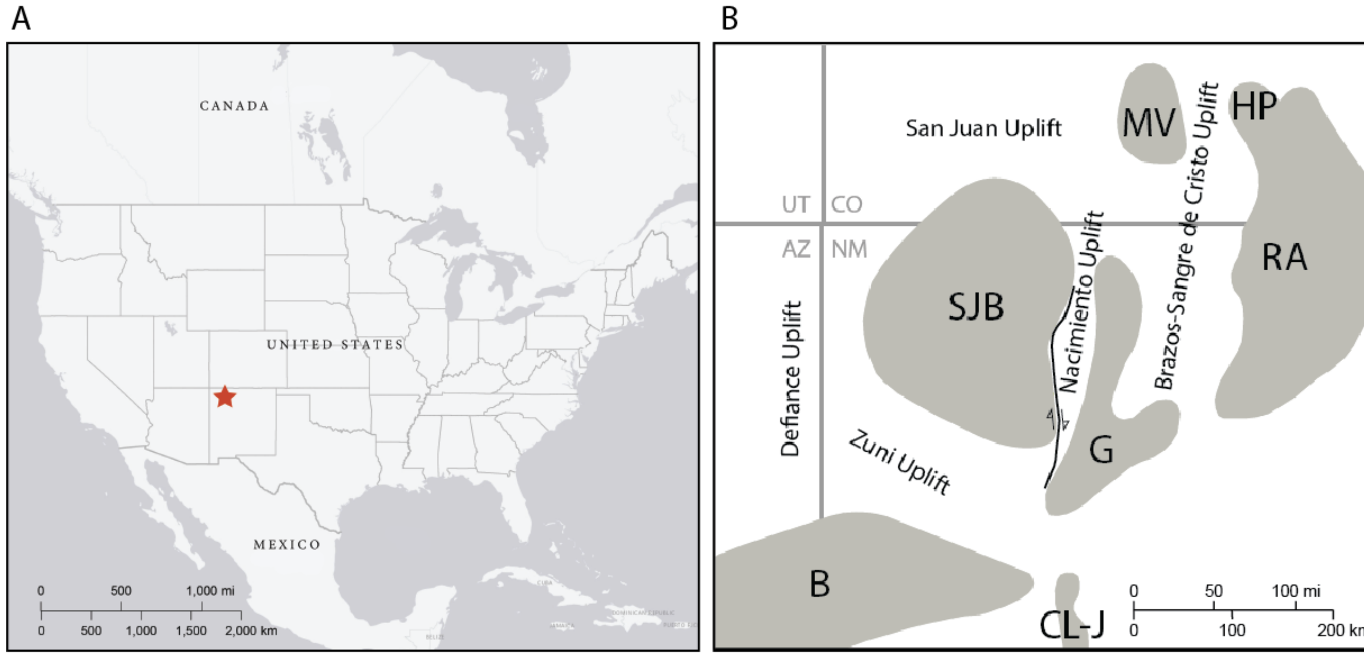

Figure 1: Maps and Paleogene geology of the San Juan Basin (SJB) A) Location of the San Juan Basin within the contiguous United States. Base map modified from ESRI, HERE, Garmin, OpenStreetMap, and the GIS user community. B) Regional map of the San Juan Basin (SJB) and adjacent basins and uplifts (SJB = San Juan Basin, G = Galisteo Basin, B = Baca Basin, MV = Monte Vista Basin, RA = Raton Basin, HP = Huerfano Park Basin, CL-J = Carthage-LaJoya). Redrawn from Dickinson et al., 1988; Lawton, 2008; and Cather, 2004. C) Paleogene stratigraphy and time constraints, modified from Smith and Lucas, 1991 D) Geological map of the SJB, areas selected for detailed investigations, and paleocurrent measurements. Arroyo Chijuilla (AC) and Continental Divide (CD) are in the southern SJB. Canon Largo (CL) is in the central SJB. Solid arrows are paleocurrent measurements collected during this study. Open arrows are paleocurrent vector means from Smith (1988). Map modified from Williamson et al., 2008 and Manley et al., 1987. E) Paleocurrent measurements (this study), not corrected to remove measurements collected from probable backsets.

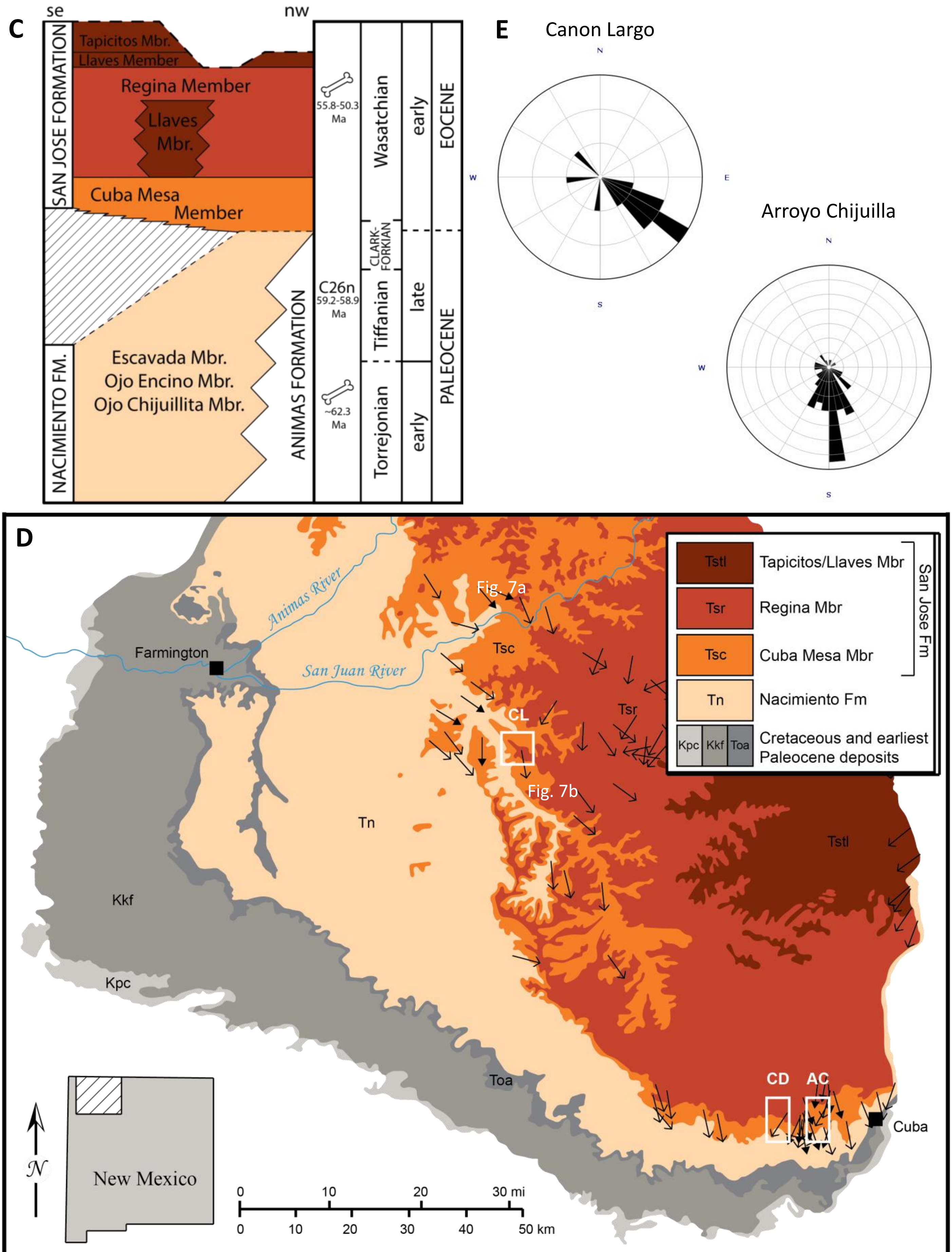

Figure 1:Continued

Figure 2: Examples of regular cross-stratification and backsets in outcrop. A) sets of regular cross-stratification with dip directions oriented to the prevailing paleocurrent direction (black arrow). **B**) Backsets (annotated in red) with dip directions approximately opposite the prevailing paleocurrent direction (black arrow).

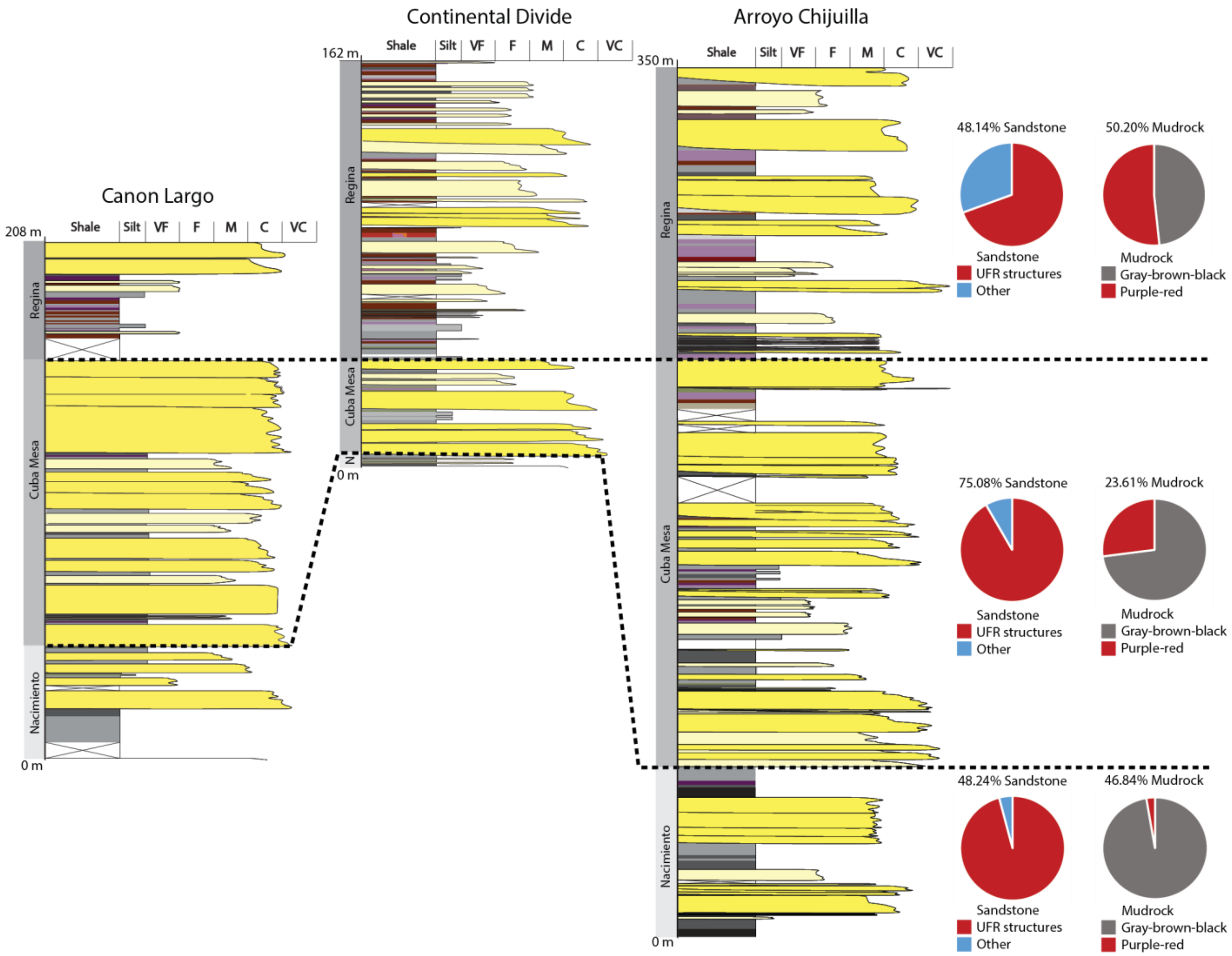

Figure 3: Measured Sections from sites selected for detailed investigation. Condensed measured sections are displayed from Canon Largo (central SJB), Continental Divide (southern SJB), and Arroyo Chijuilla (southern SJB). The percentage of sandstone vs. mudrock lithofacies and facies group composition are calculated from the three measured sections combined to quantify overall vertical trends that are seen throughout the basin.

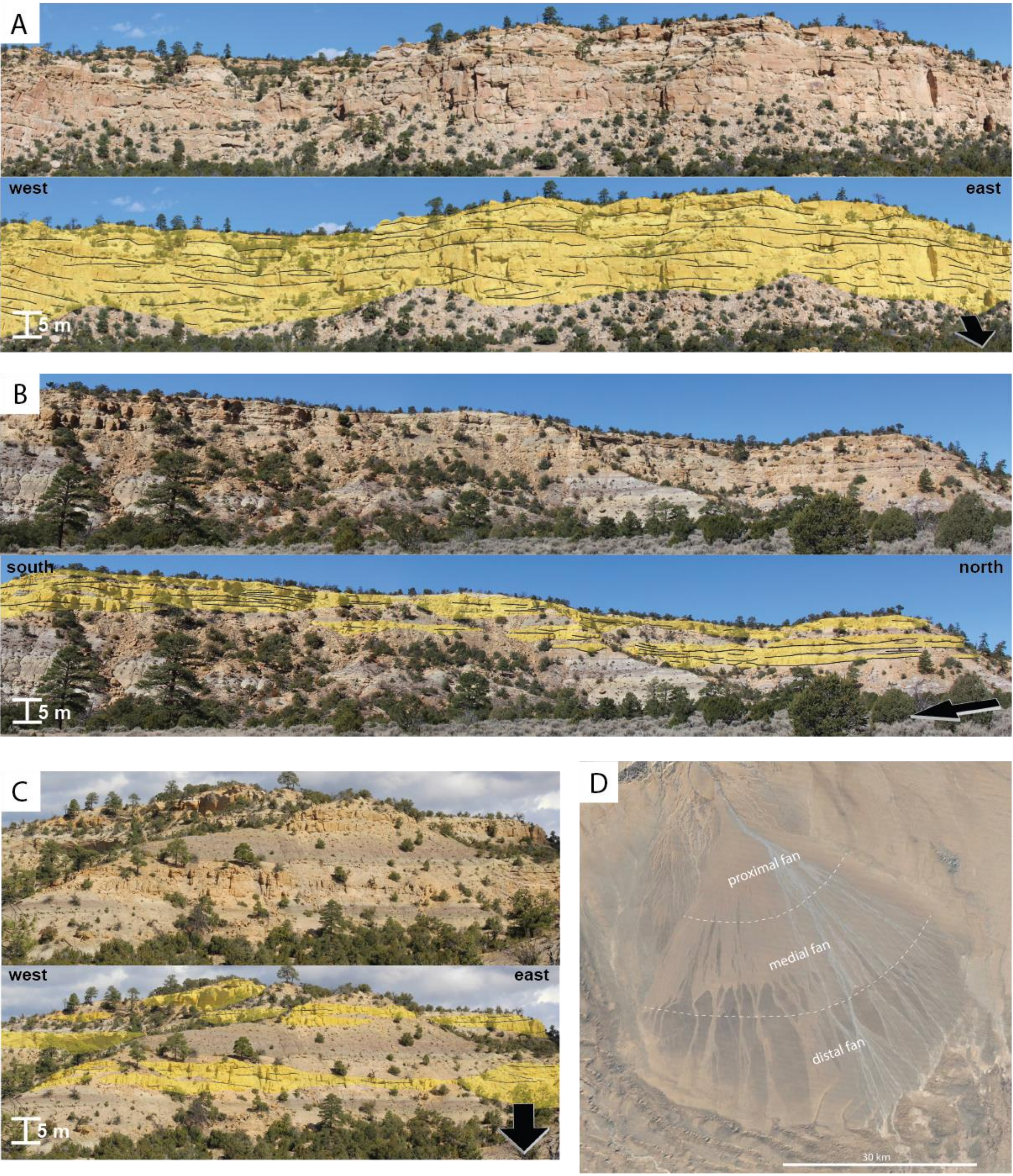

Figure 4: Architectural styles and interpretations. A) Amalgamated channels and minor floodplain (AS 1), interpreted as proximal fan facies. B) Channels and floodplain (AS 2), interpreted as medial fan facies. C) Isolated channels and dominant floodplain (AS 3), interpreted as distal fan facies. D) Satellite image obtained from Google Earth of a 60 km long Megafan in the Taklamakan Desert, Xinjiang, China with approximate locations of proximal, medial and distal fan annotated. Photos A-C are from the Arroyo Chijuilla study area.

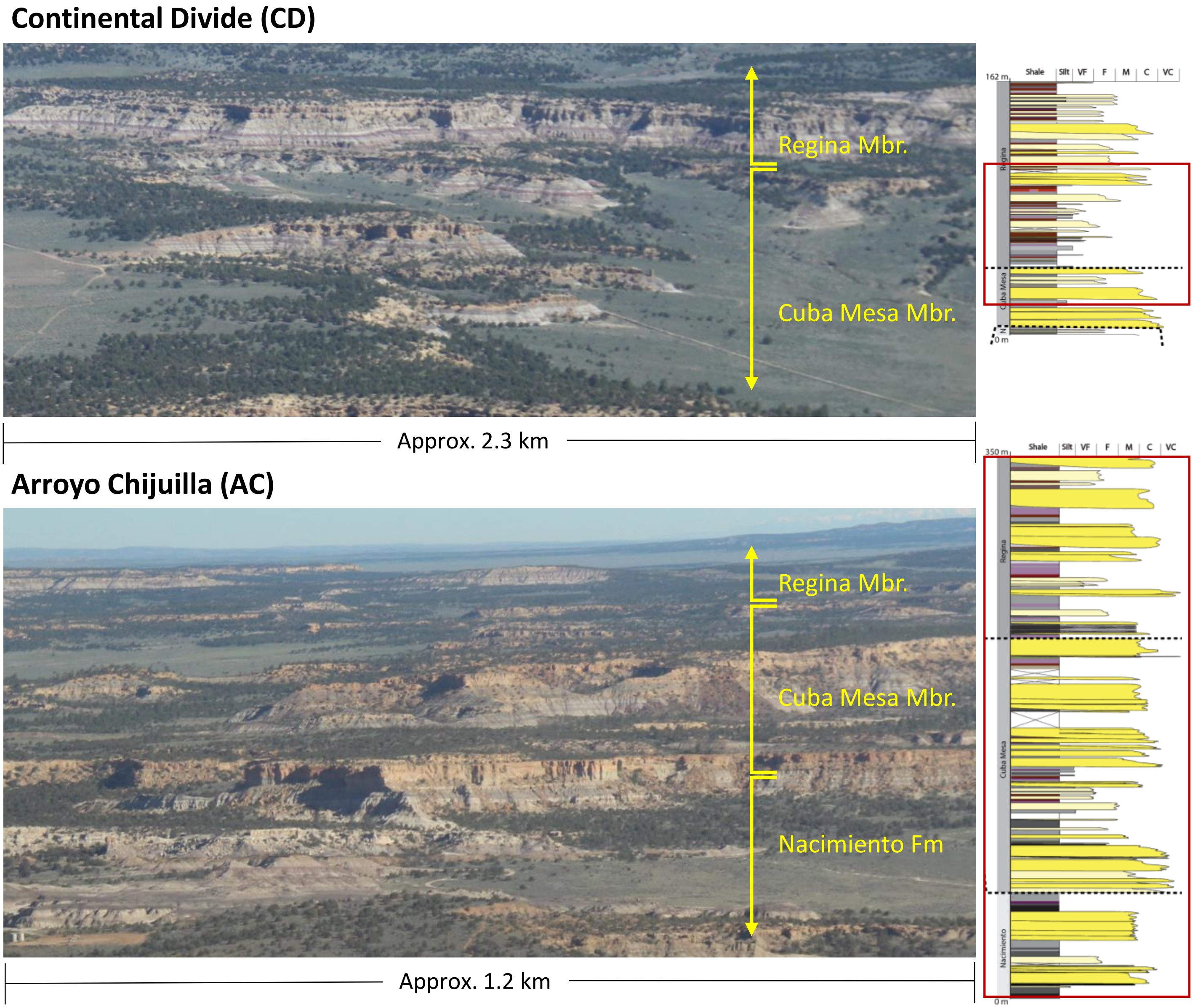

Figure 5: Lateral trends - flow perpendicular. The Continental Divide (CD) section appears condensed in comparison with the Arroyo Chijuilla (AC) section due to a greater abundance of floodplain mudrock deposits and reduced thickness of channel complexes. Due to this increased abundance of floodplain mudrock deposits, the CD outcrop may also contain a longer record of Regina Member deposits than the AC section.

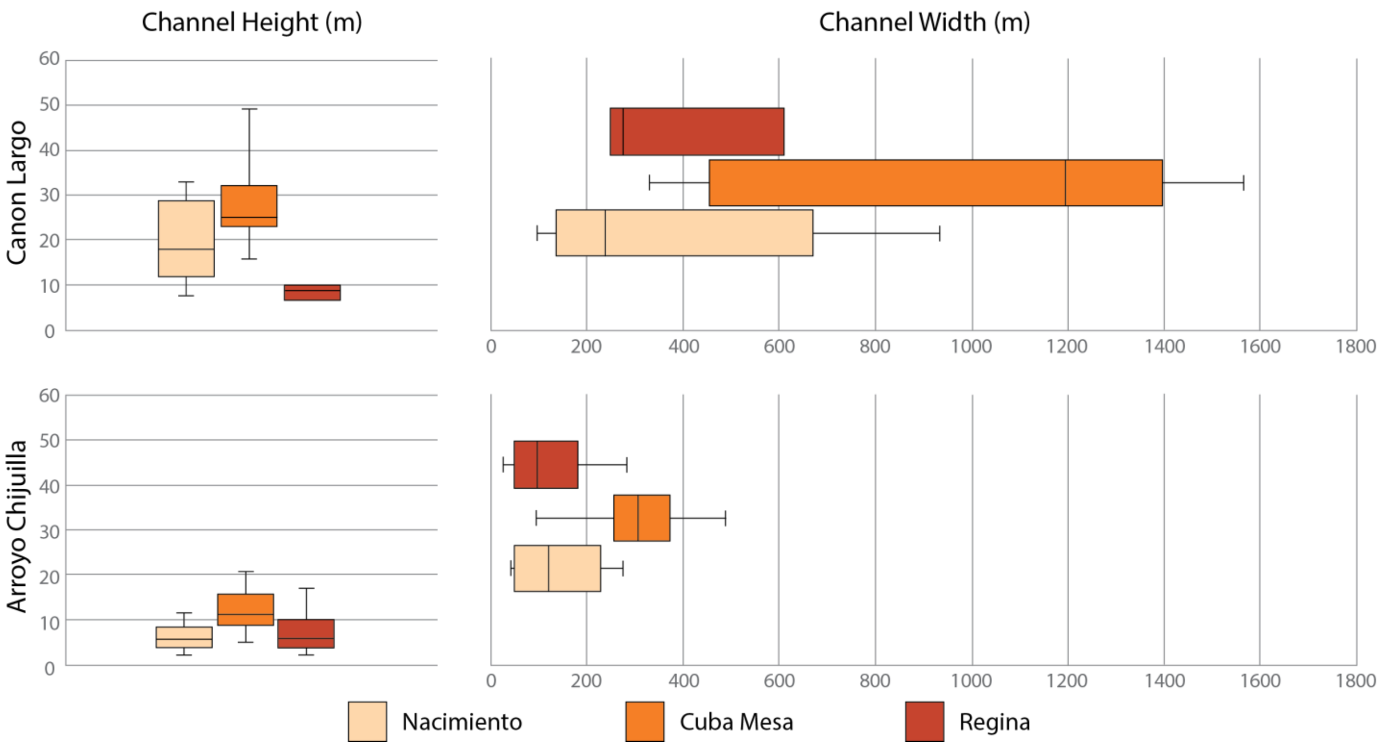

Figure 6: Channel measurements collected in the central and southern SJB. Canon Largo (CL) is located in the central SJB (see Fig. 2). Arroyo Chijuilla is located in the southern SJB. Both study areas show that the largest channels (height and width) are located within the Cuba Mesa Member. Both study areas show that the most laterally isolated channels are located within the Regina Member. There is also a downstream decrease in channel size (height and width) between the central and southern SJB (paleoflow is approximately north-to-south).

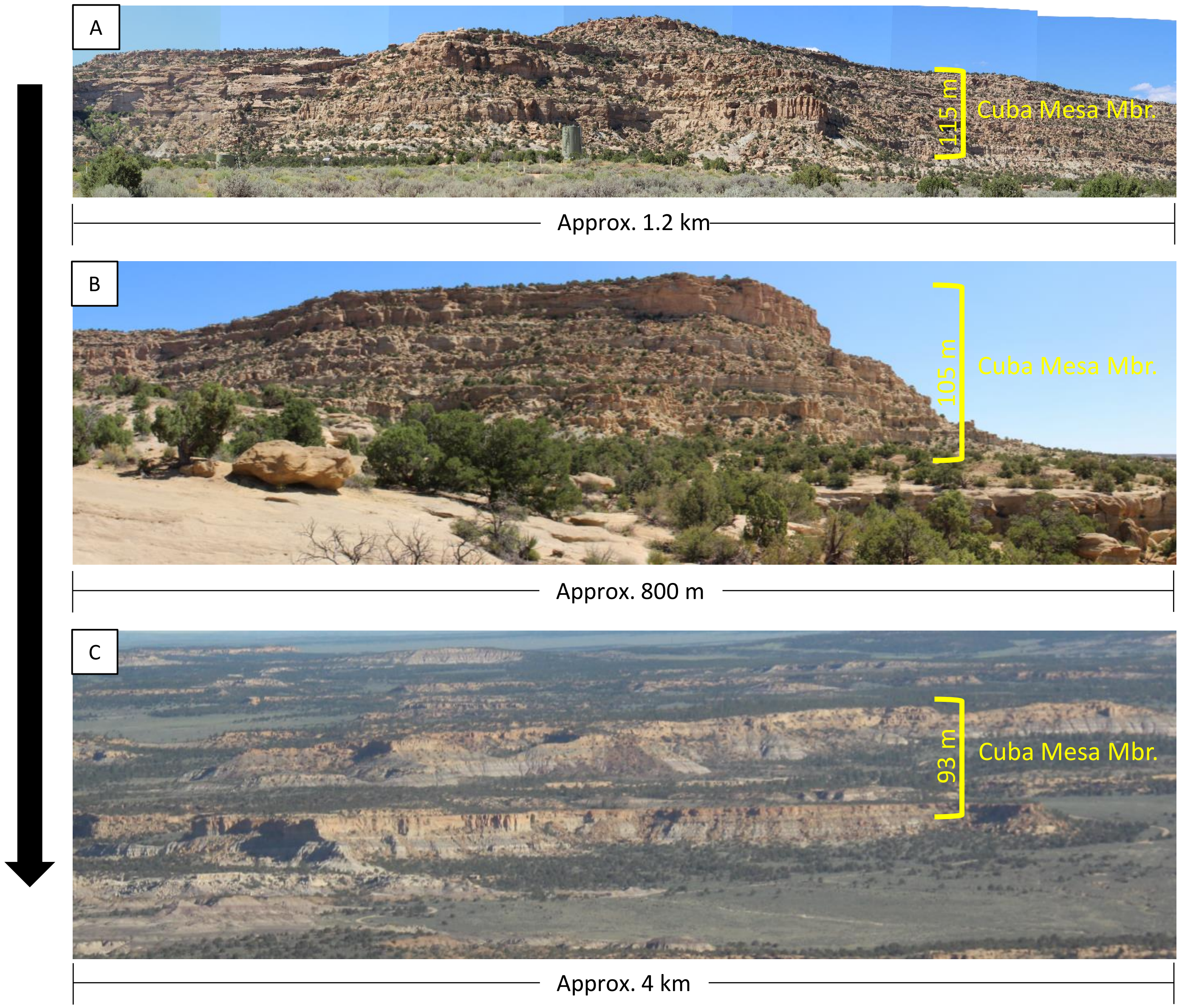

Figure 7: Cuba Mesa Member lateral trends – flow parallel. A) Highly amalgamated sandy channels in the northern SJB. B) Laterally amalgamated channels with an increase in the abundance of bounding floodplain deposits in the central SJB. C) Continued increase in the abundance of bounding floodplain deposits separating the Cuba Mesa Member channel complexes in the southern SJB. Black arrow indicates the paleoflow direction to the south. Outcrop locations for A and B are labelled on Fig. 1d, and C is an aerial photo of Arroyo Chijuilla (Fig. 1d).

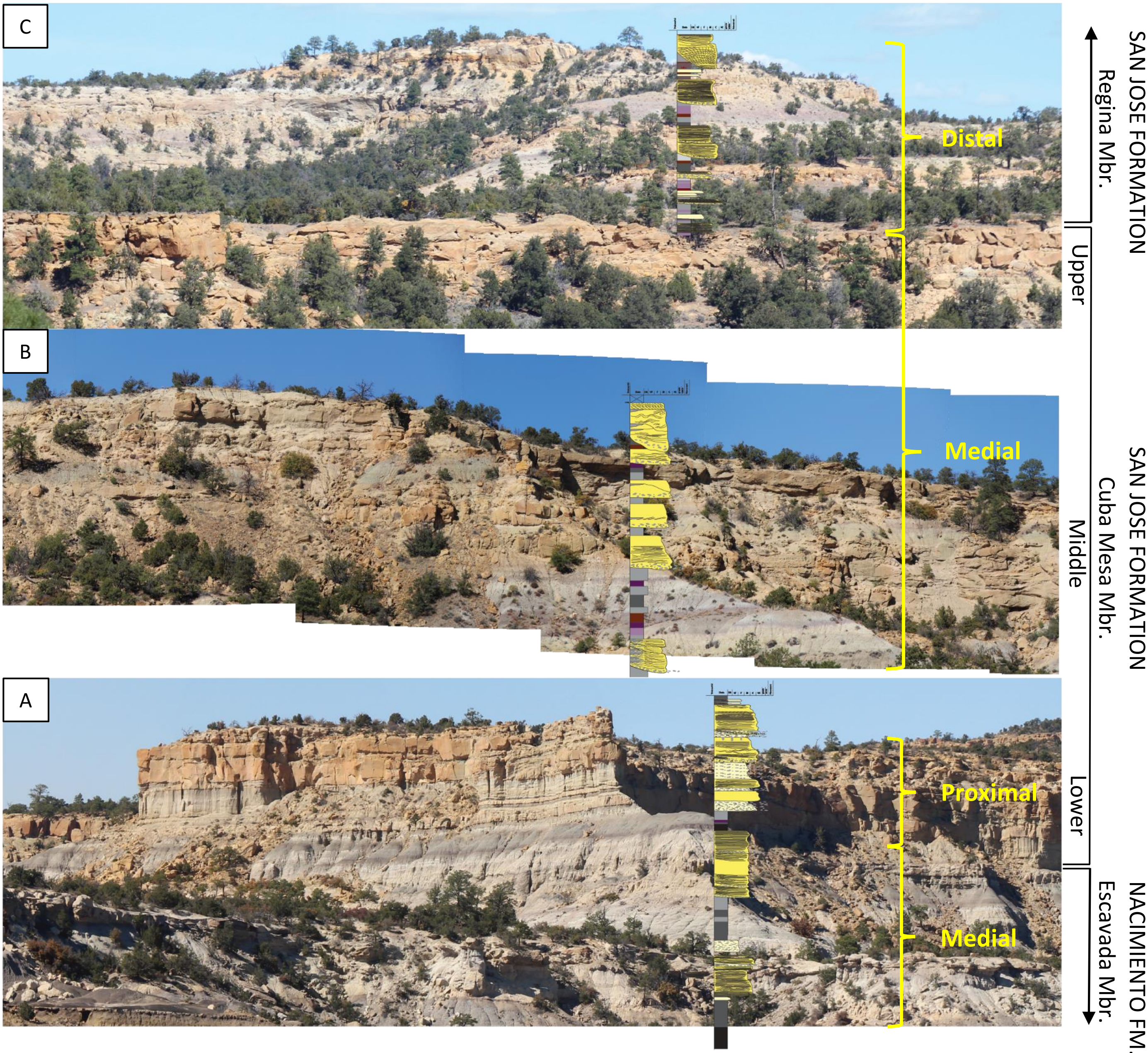

Figure 8: Stratigraphic trends the Arroyo Chijuilla study area. A) AS 2, interpreted as Medial fan facies in the uppermost Nacimiento Formation, capped by AS 1, interpreted as proximal fan facies in the lower Cuba Mesa channel complex. B) AS 2 Medial fan facies in the Middle Cuba Mesa channel complex. C) AS 2 Medial fan facies of the upper Cuba Mesa channel and overlying abrupt shift to AS 3, interpreted as distal fan facies in the Regina Member.

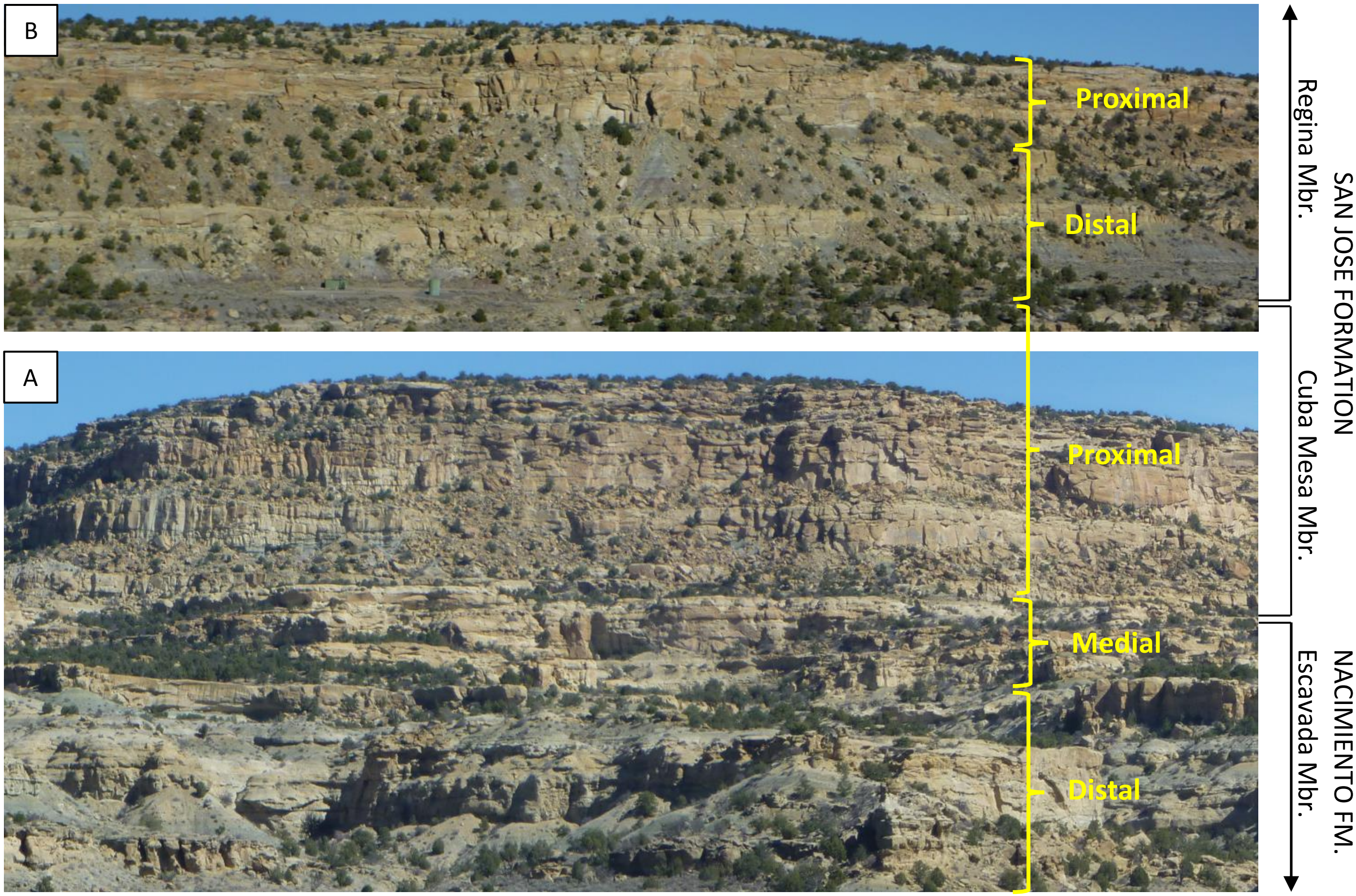

Figure 9: Stratigraphic trends in the Canon Largo study area. A) Distal to medial fan facies in the uppermost Nacimiento Formation, capped by proximal fan facies in the Cuba Mesa Member of the San Jose Formation. B) Overlying abrupt shift to distal fan facies in the Regina Member, overlain by an abrupt shift to proximal fan facies. Photos taken in the Canon Largo study area, laterally adjacent to the measured section location.

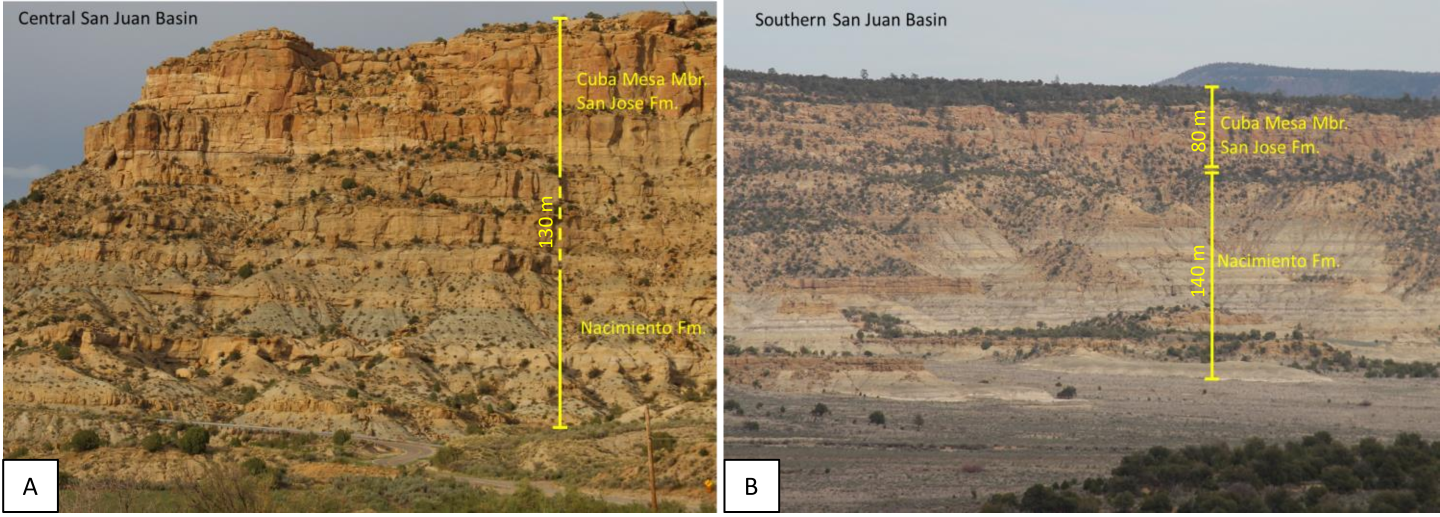

Figure 10: Different styles of fluvial fan progradation from outcrops in the central and southern SJB. A) Nacimiento – San Jose Formation transition in the central San Jan Basin near the Canon Largo study area (see map in Fig. 1d). The up-section channel thickening precludes precise placement of the contact boundary in this area. B) The transition from isolated and lenticular channels with an abundance of floodplain deposits in the Nacimiento Formation to the sandy and amalgamated Cuba Mesa Member of the San Jose Formation is more defined in the southern SJB near the Arroyo Chijuilla study area.

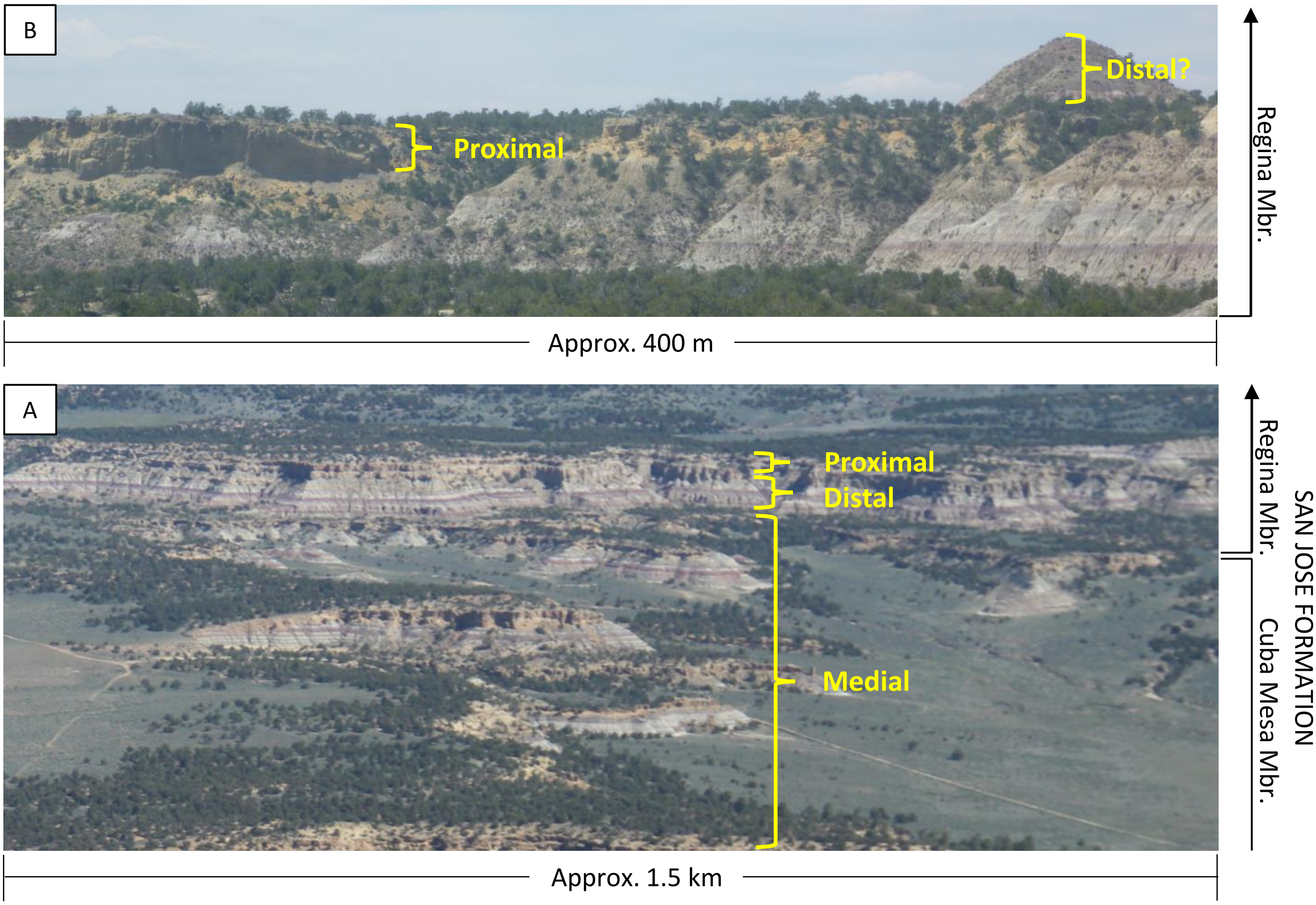

Figure 11: Stratigraphic trends in the Continental Divide study area. A) middle and upper Cuba Mesa Member "tongues" consisting of medial fan facies, capped by the Regina Member, consisting of distal fan facies overlain by an abrupt shift to proximal fan facies. B) The uppermost deposits of the Regina Member showing the limited amount of outcrop that suggests another possible shift back to distal fan deposits.

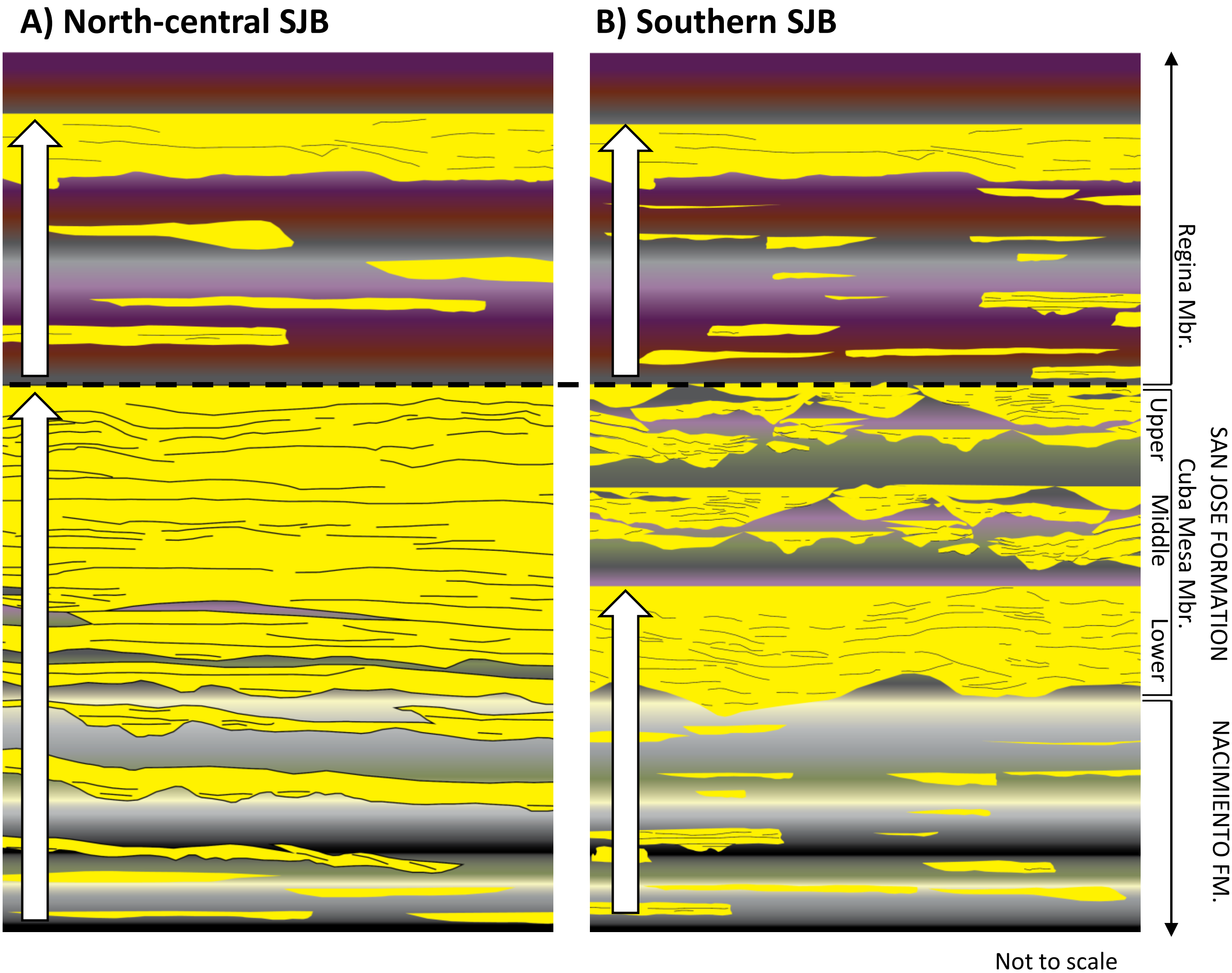

Figure 12: Illustration showing stacked prograding fan stratigraphic trends in the San Juan Basin. A). In the northern – central San Juan Basin we observe two stacked prograding packages (indicated by the white arrows) with no depositional evidence for an upstream shift in facies. B) In the southern San Juan Basin we also observe two stacked prograding packages, but there is an interval that displays upward increasing heterogeneity that could be evidence of gradual fan backstepping further away from the apex. Throughout the basin, we observe a relatively sharp shift to distal fan facies above the contact between the Cuba Mesa and Regina members of the San Jose Formation that may indicate a depositional hiatus (marked with dashed line) and period of fan inactivity prior to progradation of the second package. We also observe a basin-wide gradual upward increase in soil drainage conditions, characterized by a gradual shift from gray-brown-black floodplain deposits to increased abundance of purple-red floodplain deposits.

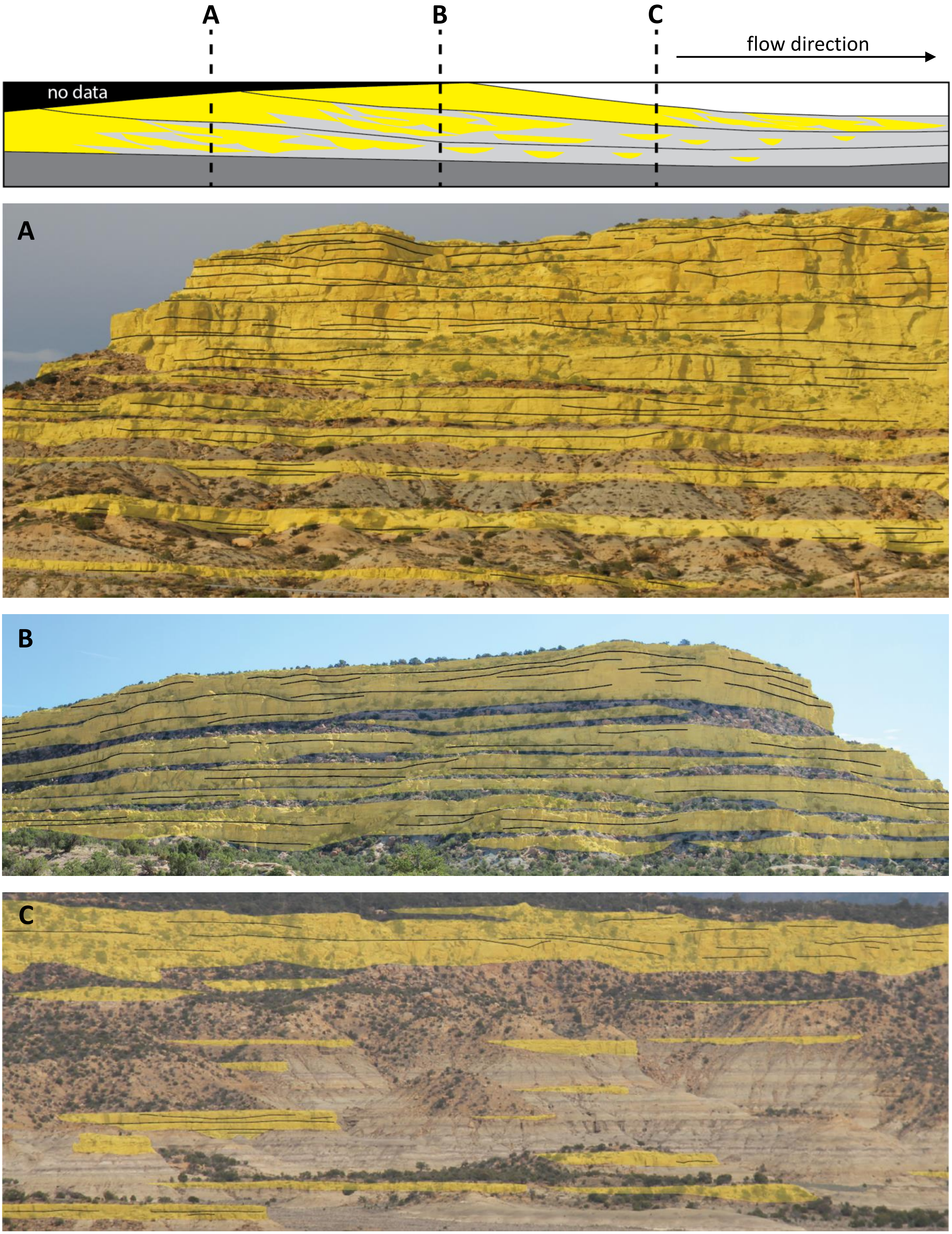

Figure 13: Schematic cross-section of hypothesized style of fan progradation and annotated outcrop photos.
A) Northern San Juan Basin. B) Central San Juan Basin. C) Southern San Juan Basin.