Frontispiece 7.6 Carbonate Platform uplifted. Devonian to Carboniferous strata exposed along the Rundle Thrust above Banff, Alberta. Viewed along strike from the northwest. The Cambrian to Jurassic Carbonate Platform succession of the Western Canada Sedimentary Basin is preserved in an undeformed state throughout the plains where it is well known from in excess of 100,000 borehole penetrations. Thrust belt décollement allows for surface examination of virtually all of the same-aged strata, in the Rocky Mountains. Photograph by G.D. Mazzac.
Introduction

The formations of a Paleozoic passive margin on the western side of the North American proto-continent played an integral part in the growth of the Western Canada Sedimentary Basin. To consider the entire 4000 km length of this western trailing edge as a non-tectonic margin would be an oversimplification, given that at least the United States portion was subjected to intense tectonic activity. The end product of this activity was the Antrim Orogeny. This event had a significant influence on the late Paleozoic growth of the cratonic margin and platform.

Cratonic Margin and Platform

Cambian-Lower Ordovician Interval

Initial Continental Margin Wedge

A regionally extensive unconformity creating disconformable, angular and nonconformable relations between the Cambrian sequence and the underlying Precambrian on both the cratonic margin and platform, was developed following deposition of the Windermere Supergraphic. Rocks of the Cambrian Gog Group probably represent initial growth of the continental margin wedge in the southern part of the Canadian Cordillera (Atkison, 1989). Further to the north, rocks of similar age appear to have been deposited in a setting where syndepositional block faulting influenced sedimentation. The Gog rocks are predominantly quartz arenites with minor amounts of mudrocks and carbonates, all totalling 2.2 km in thickness (Atkison, 1989). Sedimentary structures, trace and body fossils, and general overall character of these rocks suggest a fluviatile to deltaic depositional setting (Keppie, 1987). Their characteristic and thicknesses are typical of the rapid thermal subsidence phase of early growth of a passive margin. Readers are referred to Heintz and McMechan (this volume, Chapter 6) for a more detailed accounting of the early growth of the continental margin.

The Earliest Cratonic Transgression

Figure 7.2 depicts the inaugural Phanerzoic inundation of the proto-North American continent at the Pika/Earlie/Deadwood stratigraphic level. The transgression is typified by a basal quartzitic facies and a dolomitic dip lithofacies gradient (east-west) from inshore quartz sandstones through platform mudrocks to outer shelf carbonates. The depositional stroke of these lithofacies is subparallel to the north-northwest trend of the protocontinental margin, except where they have a westerly stroke following the inferred paleoshoreline of the Peace River/Albarcha Arch (Pugh, 1975). South of the arch, outboard deposits from the shelf-edge carbonates are thick, fine-grained silicilastics, thought to have been deposited in a submarine channel. The basinal northeast margin of the arch was influenced by an active fault system producing horst and graben features (Atkison, 1989) and a variable lithological character.

The transition from eastern platform silicilastics to outer shelf carbonates is distinctive because it is marked by an intertonguing relation that Atkison (1978) identified as Grand Cycles. He recognized two major cycles, the first assigned to the Pika and the second to the Earlie substage. The Pika is one of the earliest. Each is composed of a basal mudrock and an upper carbonate unit. The cycles are attributed to eustatic sea-level rises and falls and are considered to be excellent examples of fine-grained silicilastic-carbonate parasequences. The carbonate portion of each parasequence exemplifies shallow-water conditions that in places terminate in typical pelletal deposits. The shell margin is clearly recognizable, particularly to the southeast of the Peace River Arch, where it is marked by the Cathedral Escarpment (McBride, 1977), a typical limestones and shelly bioturbation (McLoughlin and James, 1979). Stens et al. (this volume, Chapter 8) present the detailed lithofacies character of these strata.

The Cambrian-Lower Ordovician phases of the evolution of the cratonic platform was brought to a close by a significant relative sea-level drop. In the cratonic platform it is recorded as a sub-Middle Ordovician unconformity, an erosion surface of continental dimensions, representing a lacuna extending from Early to Middle Ordovician. The extent of subaerial exposure of the continental margin deposits is not evident because the unconformity merges with a Cambrian unconformity, at least as far north as the Peace River/Albarcha Arch.

Middle Ordovician-Silurian Interval

For convenience of reference this interval is divided into four subintervals (OS1 - OS4). Each depicting a specific event in the depositional history of the cratic platform during this period of geologic time. The subintervals are similar to, but not necessarily synchronous with the subcycles described for this period by Cecile and Norford (in press).

The Second Cratonic Inundation - Subinterval OS1

For the 10 million year extent of this subinterval much of the southern part of the cratonic platform was under the influence of Montania and a northwest extension of it, commonly known as the West Albertan Ridge. Therefore, falling in a cratonic platform appears to have been from the southeast, mainly in the Williston Basin area (Fig. 10.1). The cratonic platform was invaded as a shallow marine, low, positive-relief feature, and it is also speculated that a carbonate shelf-to-basin transition existed to the west at this time.

Subinterval OS1 is illustrated in Figure 7.5, depicting the western Canadian cratonic platform at the time of initial subaerial submergence of the proto-continent. The argillaceous infill represented by the Gunn Member of the Story Mountain Formation appears to have been part of the western Nose River Shelf (Fig. 11.2). There is no indication that the component carbonates preserved in the Beaverlodge Formation, proximal to the platform-to-basin transition, can be considered the western that the platform was inundated. The paleogeography of the continental margin illustrated on the map is a simplification of that described by Cecile and Norford (in press). They interpreted the continental margin to be a region of troughs, basins, embayments and promontories, the first three containing deep-basin-to-slope deposits and the last, shelf carbonates. Arguments for the presence of depositional system boundaries, the Peace River/Albarcha and Pembina hinterland are similar to those used for the previous map, as is the argument for linking the Peace River/Albarcha and Pembina hinterland with the Peace River Arch/Albarcha and Pembina hinterland with the Peace River Arch/Albarcha and Pembina hinterland with the Peace...
Figure 7.6 portrays the fourth subinterval, the time of a shrinking carbonate sea. It is also within this stratigraphic interval that recognizable ecological reeds are identified on the eastern platform. Bailey (1951) and Stearn (1956) both described reeds from the Cedar Lake Formation of the Manitoba and Minnesota, Jardine (1979) and Kent (1948b) also reported the presence of reed-like rocks in two borehole cores from south-central Saskatchewan.

In the eastern platform this subinterval is represented by the rocks of the Interlake Formation, which appear to make up a shallow-water-upward megasequence. The lower part of the succession is clearly subtidal, but the upper part contains an assemblage of lithological features (Fairbridge, this volume, Chapter 9) that have been interpreted as indicators of a range of depositional and diagenetic mechanisms produced by subaerial exposure, vadose alteration (Haid, 1987) and freshwater sedimentation (Saganathan, 1987). The shallowing-upward megasequence was obviously a prediction of the end of the carbonate sea on the eastern platform and was followed by a period of exposure lasting some 36 million years.

The western platform may have been covered by carbonate deposits as well, but if so, their extent was significantly restricted by an enlarged Peace River/Alberstricta Arch. Evidence for the presence of shelf carbonates on the western platform is found in the Noorda Formation north of the arch (Nordfjord, et al., 1966) and in the upper Beaverfoot and Tagert farther south. The continental margin continued to be a region of troughs, basins, and embayments in which slope and deep-basin deposits, mainly shales, were laid down. Platformal procarinates, on which typical shelf carbonates were deposited, flanked the basins and embayments (Morrow, 1984; Nordfjord and Fairbridge, in press). The lower part of the initial record that is so pronounced on much of the cratonic platform does not appear to be present in the continental margin rock record, particularly north of the Peace River/Alberstricta Arch, where the succession is continuous from latest Silurian to earliest Devonian (Borel and Nordfjord, in press).

Devonian-Lower Carboniferous Interval
This interval is divided into six subintervals (D1 to D6) to facilitate the presentation of specific events in its sedimentary history. The interval presents three contrasting styles of sediment distribution pattern, and five subintervals (Figs. 7.7-7.11) are employed to show them: three representing the Devonian and two the Lower Carboniferous.

The embryonic Devonian seas were a basin flanked by the Peace River Arch, the West Alberta Basin, and the Swift Current Platform in the west and south, and the Laussanius hinterland to the north, and the Severn and Sioux arches to the east, extending as far to the southeast as the Transcontinental Arch. The initial inundation of this basin was from the northwest, a distinct contrast from the two previous depositional intervals.

A Coastal Hypersaline Basin - Subinterval DM1
The distribution of the facies in this subinterval is best described by reference to Figure 10.2 (Meier Dee, this volume, Chapter 10). It shows that the eastern platform was a land surface, and the first Devonian sediments were deposited in a sub-basin lying between the Peace River Arch and Laurussian hinterland, terminated to the southwest at a low ridge of Lower Paleozoic rocks commonly known as the Meadow Lake Escarpment. The transgressive beds are characterized by a basal sandstone, and the remaining sediments in the basin consist of red-bed sandstone, siltstone, and claystone. Interbedded with these are thick evaporite deposits of anhydrite and halite. Fuzesy (1989) interpreted the evaporites to have extended at least as far as the present erosional edge of Phanerzoic rocks in central-western Saskatchewan. Lower breccia conglomerates in the halite suggest a possible freshwater influence during salt deposition (Moore, 1989). An ostracod-bearing limonite, which is probably the equivalent of the ostracod linings of the Eriptanlan of Manitoba, Jardine (1979) and Kent (1948b) also reported the presence of reed-like rocks in two borehole cores from south-central Saskatchewan.

The coastal basin deposits pass northwestward into typical carbonate platform sediments situated on what is known as the McDonald Platform. Moore (1989) reported that the oldest Devonian coral/stromatoporoid reef development has been recognized in the carbonates of the McDonald Platform. Outboard from the carbonate platform are the typical fine-grained, siliciclastic, deep-basin deposits of the Red River Formation.

Basinal Reefs and Hypersaline Basins - Subinterval DM2
The opening phase of this subinterval is characterized by a marine, carbonate-depositing sea that transgressed the platform through a southeast-trending trough-like depression, the Elk Point Basin, extending from northeast British Columbia to southern North Dakota. Williams (1984) presented several alternatives for the shape of the basin, particularly with regard to the location of the north margin. A slight variation on his alternative (C) is the one employed in Figure 7.7. The deposits of this sea imply relatively normal marine conditions, but they have been described as having a series of shelf ridges and narrow sub-basins. This initial period of sedimentation was one in which rates of subsidence and sedimentation were approximatively equal, but it is also marked by a time of catch-up-deposition when carbonate wedges formed at the margins, while banks and both ecological and stratigraphic reefs grew on the basin floor (Fig. 7.7). There are probably several hundred reefs in the basin. Moore (1988) identified almost two hundred from the publications he reviewed, and there are another twenty or more in east-central Saskatchewan (Gendzwill and Wilson, 1984). Undoubtedly, there are many others that have not been discovered and an estimate of three hundred would not be out of order. A sizable barrier reef (Seg River Barrier) part of the Peace River barrier complex (developed across the northern end of the basin, extending northeastward from the Peace River Arch to a positive feature on the Laurussian hinterland, beyond the present erosional edge. In addition, there were several broad carbonate banks that may have restricted parts of the basin floor. In fact, Bubolz and Mazuk (1973) and Moore (1988) implied that the banks may have been sufficiently extensive to isolate the basin floor into several sub-basins. Most of the bank accumulations appear to have been in the northwestern Alberta; however, Wardlaw and Pettersen (1971) suggested that there may also have been extensive bank growth in the Saskatchewan area of central Saskatchewan. Most of the basinal reefs appear to have been initiated by growth of crinoid colonies (Langan and Chin, 1968; Martindale and Macdonald, 1990; Kent and Minto, 1991), but above the crinoidal interval the composition varies considerably. Those in the proximal end of the Elk Point Basin (northern Alberta) appear to be ecological reefs dominated by coral/stromatoporoid framework builder (Langan and Chin, 1968). Those in the basin on the eastern cratonic platform are stratigraphic reefs composed of peloidal and coalsallon algae-rich lime mudstone to wackestone, in the lower parts, with a climax reef of coral/stromatoporoid and red algae (Gendzwill and Wilson, 1987; Martindale and MacDonal, 1990, 1992; Kent and Minto, 1990) in the upper 50 m. They are divided into amorphous morphologies, from low-relief, mound-like features through pinnacle and pinnacle complexes, to flat-topped reefs.
Figure 7.2: Paleogeography of the cratonic platform and margin in the Cambrian- Early Ordovician interval. The flooding surface over which the Cambrian sea transgressed the platform was not flat, but was, in fact, interrupted by several Precambrian monoclines, particularly on the western platform (Sawatzky et al., 1990).
Figure 7.3 Palaeogeography of the cratonic platform and margin during subinterval OS1. The sandstone/mudrock relation in Manitoba is more complex than can be illustrated on a map, because the sandstones and mudrocks are interbedded and in places there are localized thick accumulations of one rock type or the other (Andishchuk, 1969; Vigreese, 1971).
Figure 7.4 Palaeogeography of the cratonic platform and margin during sub-Cambrian OSJ. The deposits of the hypersaline basin are dominantly layered aragonite. Rocks beyond the limits of the hypersaline basin are intensely dolomitized and their origin is not easily determined; however, they are thought to have been shallow marine.
Figure 7.5: Paleogeography of the cratonic platform and margin during subinterval OS3. The environment illustrated as muddy is, in fact, an argillaceous carbonate with some interlaminated mudrock.
Figure 7.6 Paleogeography of the cratonic platform and margin during subinterval OSA. Note the locations of reefs in this carbonate seaway.
Figure 7.7 Paleogeography of the cratonic platform and margin during subinterval DM2. Moos (1985) showed the La Crosse sub-basin isolated from both the Black Creek sub-basin and the Saskatchewan sub-basin by extensive carbonate banks. This map depicts a more conservative interpretation. The evaporitic unit in the basin includes anhydrite on the basin floor and enclosing the reefs, and halite and potash across the central portion of the Saskatchewan sub-basin.
Figure 7.6. Paleogeography of the cratonic platform and margin during subinterval DM3. Fine-grained sediments of the basinal marine deposits are interpreted as having been sourced in the hinterland to the north and east.
Figure 7.8: Palaeogeography of the cratonic platform and margin during subinterval DM4. The outline of reefs on the cratonic margin is based largely on Moore (1989). Palaeogeographic restoration of their positions stems from Mountjoy (1980). The hypersaline basins on the eastern platform have some anhydrite but contain mainly halite. Thicknesses of the evaporites are in the order of 30 m (Kane, 1986b; Dunn, 1978).
Figure 7.10: Paleogeography of the cratonic platform and margin during subinterval DMS. The distribution of Lower Carboniferous lithofacies suggests deposition on a relatively narrow shelf (similar to the coast of the United Arab Emirates of the Persian Gulf), leading to the inferred location of the Lower Carboniferous shoreline and the landward coastal sabkha.
The Carbont Ramp - Subinterval DM3

Moore (1989) interpreted the cratonal platform during this subinterval as a ramp, an appertinent depiction of the depositional setting, given that the Middle Devonian sea extended over the southern margin of the Elk Point Basin and spread across the north flank of the relatively low-lying central Montana hinterland, creating a seafloor with a shallow slope toward central Alberta.

During this subinterval (Fig. 7.8) the eastern cratonic platform was covered by a shallow sea in which there was cyclic deposition of shallow-water upward sequences of carbonates to evaporites (Kent, 1984a). The cycles are commonly punctuated by widespread influxes of mudrock. The original source of these mudrocks appears to have been from the central Montana hinterland, but in time, as the proportion of fine-grained siliclastic material entering the ramp area increased significantly, the source appears to have changed to a northern one (Kent, 1984a). The inference that there may have be a facies change to a more detrital depositional setting at the northern margin of the eastern platform is based largely on Kent (1984a) and Paterson et al. (1975), both of which indicate that there may have be a facies change to a more detrital depositional setting of rocks of subintervals DM3 and DM4 in that direction.

Figure 7.8 shows that the Peace River Arch dominated a sizable portion of the western platform and was bylled by an isolated platform basin filled with mixed fine-grained detrital/carbonate deposits, probably similar to those postulated to have been present along the northern margin of the eastern platform. The intraplatform basin was partly enshrouded by a carbonate shelf that also

North of the Peace River Arch, which appears to have been flanked by a carbonate shelf and reefs, the platform was sufficiently submerged to preclude reef growth and shelf development (Kent, 1974; Grinsell, 1968; Towle and Moore, 1989). The reefs generally have a distinctive zonation of biota from margin to interior and are dominated by stromatoporoids and corals (Fischbuch, 1968; Lavoie, 1966; Jeness and Fischbuch, 1974).

Moore (1989) indicated that the northwest outboard margin of the entire cratonic platform was dominated by a large reef complex that passed laterally into the deep basin, fine-grained siliciclastics of the Besa River Formation. There is no clear evidence to demonstrate the depositional setting was on the continental margin or northwest of the Peace River Arch, but it is quite likely that deep basinal conditions prevailed.

Reefs, Shale Basin and Carbonate-evaporite Shelf - Subinterval DM4

Subinterval DM4 was a continuation of DM3 (Fig. 7.9). The eastern platform was covered by an extremely shallow-water shelf sea; a modern analog with respect to water depth and sediment types might be Florida Bay. Reefs belonging to the Dupen Formation are representative of this subinterval. They consist of numerous shallow-upward, evaporite-bearing cycles (Kent, 1984a) commonly terminating in aragonite. Within the shelf sea there were at least two large, hypersaline sub-basins, Youngstown-Estonia and Flat Lake, in which halite was deposited (Kent, 1980a, 1989; Dunn, 1976). The Dupen Formation succession also reflects an increase in the influx of fine-grained siliciclastic sediment toward the close of this subinterval. The mudrocks appear to have had their source from the northern margin of the eastern platform (Kent, 1984a, 1986a). This proposal corroborates Oliver and Cowper's (1963) interpretation. They used westerly flowing deep bottom currents as evidence for the presence of such a basin in the eastern plains of Besa Lake basin, having had a northeasterly source. On the other hand, Stokas (1980) inferred that the siliciclastics of the eastern basin were carried by southerly currents flowing between the Peace River Arch and the Grosmore Basin. He attributed the western dip of the shelf carbonate to a southerly source. As both sources have passed between the Grosmore Basin and that hinterland.

The shelf deposits extended into eastern Alberta where they terminated at the Killam shelf marginal reef complex, marking the end of the depositional transition to a basin setting in which an assemblage of reefs, carbonate banks and isolated platforms grew. (References to these rocks are too numerous to be cited in this overview; see Moore et al. 1989 for a more complete discussion). Moore (1988) and others in Goldszer et al. (1988) for additional information on this topic.) Reef growth was inaugurated on a broad carbonate ramp, the consequence of a Late Givetian to Early Frasnian transgression (Moore and Goldszer, 1988). Although fine-grained siliciclastic sediment was deposited on much of this ramp, the reefs were established on paleoethbathymetrically positive features, and their extremely rapid growth rate outpaced the accumulation of sediment, thereby preserving the ramp. As the ramp was occupied by an elagane, carbonate shoal upon which developed the Grosmore complex. This complex grew vertically, as a result of prolonged time, to about 200 m thick (1960-1967). Both Instruction (1978) and Paterson (1978) interpreted the basal ramp as a carbonate shelf, reef and evaporite facies. A typical reef on this complex is the Alexandria Reef (Jennings, et al., 1971).
PERMIAN (PT1) PALEOGEOGRAPHY

Figure 7.13 Paleogeography of the cratonic platform and margin during the Permian part of subinterval PT1.
Figure 7.14  Paleogeography of the cratonic platform and margin during the Triassic subinterval (PT2).
CRATONIC PLATFORM

(1987) also delineated a cluster of Waukonsian-type mounds in the lower slope setting of extreme southeastern Saskatchewan. Other mounds in the same subsequence have been found in a comparable paleoaltimetric setting in the Central Montana Trough (Cotter, 1961; Stone, 1972) and the Peace River Embayment (Morgan and Jackson, 1979; Davies et al., 1988).

The rocks on the eastern platform are much like those along the pericratonic margin, consisting of transgressive-regressive cycles of skeletal-oolitic carbonates (Richards, 1989). However, the nearshore carbonates, siliciclastics and evaporites were probably eroded from the eastern platform. Sera (1990) and Young and Rosenthal (1991) showed that the shelf and basin complexes comprise sets of parasequences.

In the Rundle-Mission Canyon subinterval the carbonate depositional setting for the Williston Basin was more ramp-like, and although the sequence is marked by transgressive/regressive cycles, there is an overall progradation toward the basin centre with peritidal carbonates prograding over terrace and outer shelf depositional Figure 7.12 is an attempt to depict this progradation, and the terraces and shelf facies are shown as having migrated basinward with respect to their postulated position in Figure 7.10. The western platform is marked by a similar progradational shelf sequence but the shelf break is much better defined; the shelf carbonates pass into slope carbonates, which in turn pass into basinal siliciclastics in the Prople Trough (Richards, 1989).

North of the Peace River Embayment, which was a well defined feature during this subinterval, the depositional setting continued to be one in which fine-grained clastics and siliciclastic carbonates accumulated. In late Early Carboniferous time most of the western platform became dominated by deltaic, coastal plain, and fluvial deposits, as represented by the Mattson assemblage (Richards, 1989).

Upper Carboniferous to Triassic Interval

Demise of Passive Margin Sedimentation - Subintervals PT1 and PT2

The shallowing-upward cycles of the Lower Carboniferous heralded the progradational shelf in a level that is characteristic of the PT interval on the cratonic platform. Continental sedimentation on the eastern platform was initiated as early as the late Early Carboniferous, as evident from the Poplar Beds of the Madigan Group and the Kibby Formation of the Big Snowy Group in southeastern Saskatchewan, which have recognizable continental characteristics. In addition, the rocks of the Mattson assemblage demonstrate a switch to coastal plain and continental sedimentation along the western platform in latest Early Carboniferous time (Richards, 1989). At the present time, rocks of the Upper Carboniferous-Pennsylvanian subintervals have limited distribution in the foothills and Rocky Mountains, probably for two reasons: 1) their deposition was confined to the ancestral continental margin; and 2) according to Henderson (1989) they have been truncated by at least four major unconformities.

Henderson (1989) suggested that the dominance of siliciclastics in these strata is related to the drifting of Pangaea into subtropical and warm temperate latitudes where carbonate sedimentation was subaerial. Any carbonates that were deposited were formed in a mixed siliciclastic-carbonate setting.

Upper Carboniferous rocks are the most seaward actively. In their lower few occurrences, Henderson (1989) recognized shallow to deepshelf deposits as well as assemblage coastal andesine in the Storlek Formation, the Spry Lakes Group. In the Permian rocks (Fig. 7.13), shelf, slope and basin deposits are recognizable (Henderson et al., this volume, Chapter 15), but according to Henderson (1989), with the exception of some nearshore and peritidal carbonates, the remaining rocks appear as though they were deposited below fairweather wave base. They contain a preponderance of phosphatic deposits and coarse- and fine-grained clastics. The former are commonly glauconitic. In places the slope sediments are starved deposits, as indicated by abundant phosphatic sediments. Elsewhere, particularly north of the Peace River Embayment, they are covered by turbidites. The basin facies, preserved mainly on the eastern side of the Kield (Prophet) Trough, are generally siltic, channel, agglutinitic limestone, siltstone and shale. The nature of the western margin of the trough is speculative, at best. Henderson (1989) suggests that the Cassiar Terrane may have been a subaerially exposed part of the rim. In the Barkerville Terrane there is evidence to indicate that the marine setting proximal to the rim had sedimentary deposits and volcanics.

A Late Permian drop in sea level exposed the rocks of that age to erosion, and in places the uppermost Palaeozoic strata were completely stripped away. This low sea level stand also established the initial setting for Triassic sedimentation. Gibson (1974) identified the basal Triassic strata along the ancestral continental margin (Fig. 7.14) as representing deltaic and fluvial flat deposits, suggesting a lowstand shoreline. Gibson and Barclay (1989) interpreted the entire Triassic succession along the length of the cratonic margin of that time as comprising at least three transgressive/regressive cycles. Each contains rocks typical of a marine shelf setting ranging from distal shelf waters to proximal shoreline (Edwards et al., this volume, Chapter 16). The deltaic deposits are characterized by carbonates and fine-grained siliciclastics, and the proximal depositional by deltaic facies of the type of Parry Sound and typical sabkha evaporites (Starlight and Charlie Lake).

The sediments that accumulated on the eastern platform during this subinterval reflect the aridity of climatic conditions of that time. They were predominately redbeds, dominated by mudstone and silt and local sand bodies (Cumming, 1956; Brenchley, 1980). Displaceable ash beds are also common within the sequence. The deposits are dominated by continental sedimentation, but some of the thin, yet more continuous, lithostratigraphic units have led Brenchley (1980) to invoke marine sedimentation for their origin.

The rifting of Parry Sound and the eastern part of the Ancient Terrane was initiated during the Permian epoch. This event terminated the more or less trailing edge deposits that had prevailed since the proto-continent was formed some 600 million years before, and initiated foreland basin sedimentation.

Summary and Conclusions

Throughout most of the evolutionary history of the cratonic platform, the passive margin prevailed as a site of sediment accumulation. On the platform, an assortment of sediment distribution patterns, related to cycles of transgression and regression, punctuated its history. The inaugural Cambrian inundation was from the west. Following a regression and second transgression, this time from the southeast, the cratonic platform entered into a lengthy phase of carbonate sedimentation (Late Ordovician to Silurian), predominantly on the eastern portion.

The third inundation (Devonian), from the northwest, spread deeply into the interior of the cratonic platform through a south east-trending embayment. Through time the seaway expanded into a ramp and then to a re-occupied shelfal basin with a broad carbonate-evaporite marginal shelf in the eastern platform. Collision of the western continental margin with the Azalea allochthon during the latest Devonian and earliest Carboniferous initiated sedimentation in narrow shelf-to-basin facies belts that followed the depositional strikes of a series of basins and troughs in the western platform and along the passive margin in the west.

In the last phase of the evolution of the cratonic platform (Late Carboniferous-Pennsylvanian and Triassic), marine sedimentation was again restricted to the passive margin while the platform underwent erosion and continental sedimentation.

In conclusion, the geological history of the cratonic platform can be summarized as two periods of continental margin sedimentation separated by cratonic inundations from the west, southeast, and northwest. The amount of craton submerged during any one transgression was controlled by an assemblage of arcs, including the Peace River Albasan, the Severn Sioux, the West Alberta Ridge, Montana and the Sweetgrass/North Battleford and the Central Montana Uplift.

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