Cretaceous Stratigraphy in Four Cores from the Vicinity of the Fort-à-la-Corne Kimberlite Field, East-central Saskatchewan – Preliminary Results

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1. Introduction

In this paper, we examine the stratigraphic relationships of two intriguing and significant features of the Cretaceous geological record in east-central Saskatchewan. The first is the occurrence of diamond-bearing kimberlite bodies in Late Albian strata (Figure 1). The second is the occurrence of unconformities and condensed stratigraphic units that are of Early Cenomanian to Early Campanian age and that converge towards the kimberlite field but were developed after kimberlite activity ceased (Figure 2).

At least 69 kimberlite bodies have been documented in east-central Saskatchewan (Jellicoe *et al.*, 1998). Kimberlite activity must have been triggered through deep-seated tectonic controls, although the exact mechanism has not been documented. Jellicoe *et al.* (1998) suggested that the Saskatchewan Craton (Chiarenzelli *et al.*, 1996) provided a thick lithospheric keel which is thought to be important in the generation of kimberlitic magmatism. A significant characteristic of the kimberlite deposits is that no pipes of diatreme facies have yet been drilled. The known kimberlites consist only of volcaniclastic "crater facies" deposits and associated marine and fluvial reworked sedimentary kimberlite facies. They are contained within terrestrial to marine sedimentary rocks mainly of Albian age (one Cenomanian age has been recorded). The marine reworked kimberlitic material may hold the greatest promise for concentrations of diamonds.

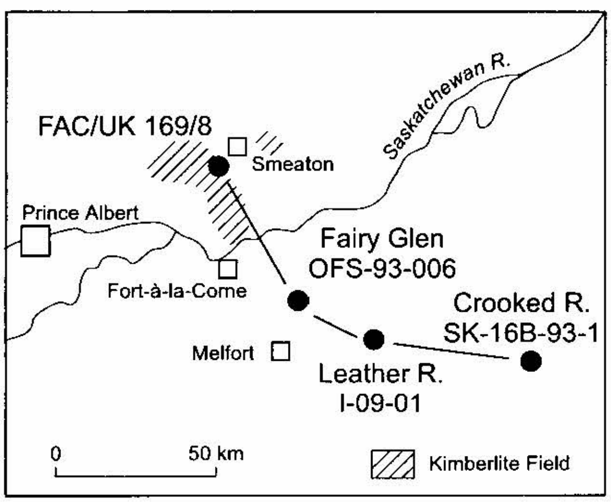

***Figure 1** - Location of four cores studied in the Fort-à-la-Corne area of east-central Saskatchewan.*

The underlying cause of the unconformities and condensed sections in Cretaceous strata is not well established. In different combinations, tectonic movement, eustasy, movement of water masses, and sedimentation rates could have been responsible. Numerous previous studies (e.g. North and Caldwell, 1975; Williams and Baadsgaard, 1975; McNeil and Caldwell, 1981; McNeil, 1984) have documented major unconformities above and below the First and Second White Specks formations and the Pembina Member, Pierre Shale. A clear understanding of the causal mechanisms and the detailed stratigraphy has not, however, been reached. Little or no Cretaceous stratigraphic information existed for the Fort-à-la-Corne area prior to recent research stemming from kimberlite exploration. Current research will shed light on the Cretaceous stratigraphic anomalies of the area in addition to kimberlite-related stratigraphy.

2. Previous Work and Methodology

In order to establish the stratigraphic relationships between Cretaceous sediments and kimberlites in the Fort-à-la-Corne area, preliminary lithostratigraphic and biostratigraphic data are presented from four cores which form a 126 km long cross-section through east-central Saskatchewan (Figure 1). The cross-section illustrates the position of kimberlites in the Smeaton FAC/UK 196/8 core relative to non-kimberlitic Cretaceous strata cored in three wells: the Rhonda Fairy Glen OFS 93-006 (13-35-47-18W2), the Kennecott Leather River I-09-01 (1-4-45-10W2), and the Kennecott Crooked River SK-16B-93-1 (4-23-46-16W2). Previous studies on the Smeaton core (Leckie *et al.*, 1997) documented the occurrence and characteristics of the kimberlites which consist of pyroclastic airfall crater deposits overlain by marine sedimentary reworked kimberlite facies and marine mudstones of the Late Albian Westgate Formation.

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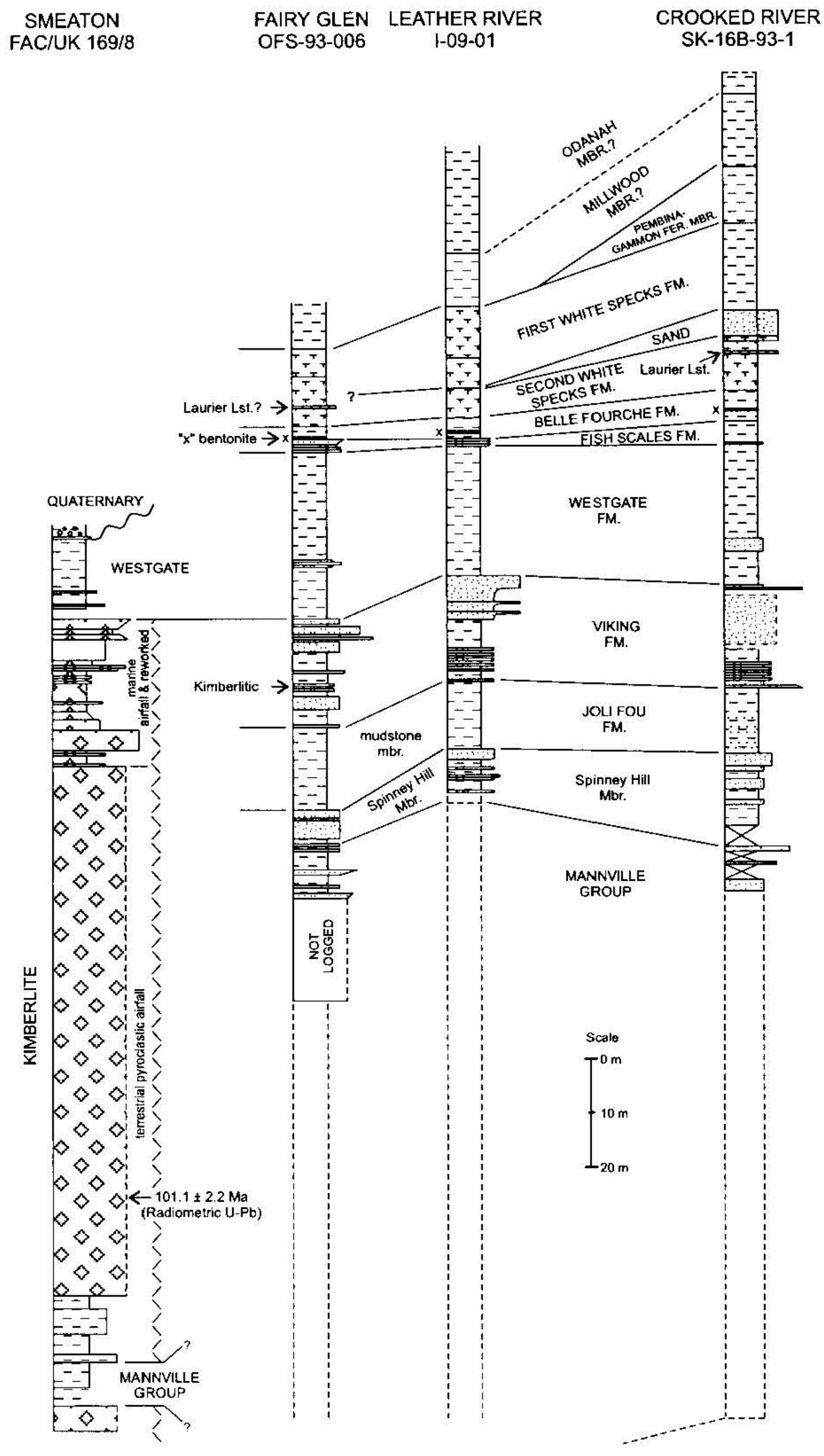

Figure 2 - Stratigraphic cross-section of cores from four boreholes in the Fort-à-la-Corne area, east-central Saskatchewan. Datum is the base of the Fish Scales Formation. The Cretaceous stratigraphy and kimberlitic succession in the Smeaton FAC/UK 169/8 borehole is summarized from Leckie et al. (1997). The thickness of the Mannville Group is projected from nearby exploration wells. The Smeaton FAC/UK 169/8 core is stored at the Geological Survey of Canada (Calgary) and the other three cores are stored at the Saskatchewan Energy and Mines Subsurface Geological Laboratory in Regina.

McNeil and Gilboy (1999) presented a preliminary correlation between the Leather and Crooked River cores. White *et al.* (1999) reported on the Albian-Cenomanian chemostratigraphy and sequence stratigraphy in the Crooked River core. In the current study, the Fairy Glen (FG), Leather River (LR), and Crooked River (CR) cores have been described lithologically and sampled for geochemical, nannofossil, palynological, and microfossil analysis. Stratigraphic descriptions have been completed for all the wells and preliminary paleontological data on the foraminifera are now available for the LR and CR cores.

3. Kimberlites

The Fort-à-la-Corne kimberlite field contains at least 69 kimberlite occurrences (Jellicoe *et al.*, 1998), all of which consist of volcaniclastic "crater facies" deposits. Volcaniclastic kimberlite deposits of this type are relatively uncommon as most kimberlites occur as diatreme pipes in eroded Precambrian terrains. Recent radiometric age determinations by Larry Heaman (University of Alberta) and Bruce Kjarsgaard (Geological Survey of Canada, Ottawa) indicate that ten of twelve kimberlite bodies examined in the Fort-à-la-Corne field were emplaced between 99 and 101 Ma (Kjarsgaard, pers. comm., 2000). Many kimberlite bodies in Fort-à-la-Corne field have been cored; but, the Smeaton one is the only one which has been geologically described in detail (Leckie *et al.*, 1997). Therefore it is utilized in the stratigraphic cross-section linking the kimberlites to Cretaceous strata to the southeast (Figure 2).

The main kimberlite section in the Smeaton core is a 77 m-thick conformable succession of pyroclastic lapilli- and olivine-dominated airfall deposits overlain by 25 m of subaqueous pyroclastics and marine reworked kimberlite facies (Leckie *et al.*, 1997). An older, undated, fluvial-reworked kimberlite also lies at the base of the Smeaton core below Middle Albian Cantuar sediments. A U-Pb radiometric age of 101.1 ±2.2 Ma was determined from perovskite in the lower part of the terrestrial kimberlite section. Marine mudstone sediments of the lower Westgate Formation were estimated to be ca. 100 Ma based on regional biostratigraphic correlations with the standard zonations and chronologies for the Western Interior Cretaceous (McNeil *et al.*, in press). Biostratigraphic data from agglutinated foraminifera indicate that the lower part of the Westgate Formation is fully preserved in a transgressive facies overlain by a truncated regressive marine facies. Stratigraphic relationships and radiometric ages, therefore, confirm that the main kimberlite section in the Smeaton core was emplaced at the time Viking Formation sediments were being deposited in the Western Canada Sedimentary Basin (WCSB). This appears to be corroborated in the Fairy Glen core, 44 km to the southeast (Figure 2), by possible indicator minerals (garnets?) and thin kimberlitic rocks in the lower part of the Viking Formation. The absence of the uppermost Mannville Group, the entire Joli Fou Formation, and typical Viking Formation sediments at the Smeaton location remains enigmatic. Available data suggest that the kimberlite explosive eruption must have displaced the missing units, but it is not clear how this would occur and leave the Cantuar section intact, unless the explosive forces were laterally abrupt and violent near the surface. Alternatively, kimberlite deposition might have occurred at the same time as upper Mannville sedimentation.

In the Smeaton core, microdiamonds 5 to 25 µm in size were recovered from the kimberlite airfall facies (Leckie *et al.*, 1997). In the marine-reworked facies, indicator minerals were abundant in samples that were processed for microfossils from 115.5 to 121.1 m. At 115.1 to 115.22 m, a coarse, diamond-bearing transgressive lag deposit is present. Unfortunately, a 2.3 m gap in the core occurs immediately above the transgressive lag. McNeil and Gilboy (1999) have illustrated stratigraphic relationships between the kimberlite and the Westgate and Viking formations in the Smeaton and Crooked River cores.

4. Cretaceous Strata, Unconformities, and Condensed Sections

Cretaceous strata in the Fairy Glen, Leather River, and Crooked River cores can be grouped into three discrete packages that appear to have undergone markedly different conditions of sedimentation. The packages consist of the Mannville Group to Westgate Formation (more or less continuous non-marine to marine sedimentation), the Fish Scales Formation to the Pembina Member of the Pierre Shale (marine strata most affected by unconformities and condensation), and the Millwood and Odanah members of the Pierre Shale (continuous uniform marine sedimentation). It is not known if the Cretaceous stratigraphic relationships were influenced by mechanisms responsible for kimberlitic activity. The Albian sedimentary package does not seem to have been affected in any of the cores. In contrast, the Cenomanian–earliest Campanian package is increasingly condensed and affected by unconformities towards the kimberlite fields.

a) Mannville Group to Westgate Formation

Stratigraphic continuity appears to have been the norm during upper Mannville Group sedimentation through that of the Westgate Formation. The emplacement of kimberlites in the Fort-à-la-Corne area apparently had little affect on Albian depositional patterns to the southeast as there is no obvious stratigraphic influence or sign of kimberlitic eruptions except for two thin layers of possible kimberlitic material in the Viking Formation, Fairy Glen core (Figure 2). At the site of the kimberlite craters, however, it is a different story. In the Smeaton core, uppermost Mannville to Viking sediments are absent. This section is made up of kimberlitic rocks ca. 101 Ma. Marine reworking of the uppermost kimberlite represents the marine transgressive systems tract that constitutes the upper part of the Viking Formation.

The upper part of the Mannville Group has been cored in the three boreholes studied, but stratigraphic subdivisions within the group have not been picked. Its overall thickness is approximately 90 to 150 m based on interpretations from nearby exploration wells. Relief on the sub-Cretaceous unconformity apparently controls marked variations in the thickness of the Mannville Group. Sediments that are present in the core consist of terrestrial shales, siltstones, and sandstones. Some units are highly bioturbated, plant remains are common, and highly organic layers including coaly beds up to 15 cm thick are abundant. The upper contact with the Spinney Hill Member of the Joli Fou Formation is sharp and occurs above calcite- and pyrite-cemented sandstones that are highly bioturbated. A transgressive marine surface of erosion probably marks the boundary with the overlying Joli Fou Formation.

The Joli Fou Formation maintains a uniform thickness of 26 or 27 m in the FG, LR, and CR cores. Its lower part consists of the Spinney Hill Member and the upper part is informally referred to as the Joli Fou mudstone member. The Spinney Hill thins slightly towards the northwest from 15.3 to 13.6 m and the overlying mudstone member thickens proportionately. The Spinney Hill is characterized by very fine- to fine-grained glauconitic sandstone beds, 10 cm to 2.5 m thick, with thin mudstone and shale interbeds. Bedding is generally low angle with hummocky cross-stratification also present. Sandstones are moderately to highly bioturbated with *Terebellina*, *Planolites*, *Chondrites*, *Zoophycos*, and *Asterosoma* present. Fine-grained sedimentary rocks contain *Chondrites* and *Planolites*.

The Spinney Hill Member contains a prolific assemblage of agglutinated foraminifera of the *Haplophragmoides gigas* Zone of early Late Albian age. A concentration of fish fragments at the base of the member (CR core, 237 m) probably represents a transgressive lag and the initial flooding surface for the Joli Fou sea. Foraminifera consist of robust, coarsely arenaceous species dominated by *Lagenammina*, *Ammodiscus*, *Haplophragmoides*, *Ammobaculites*, *Ammobaculoides*, and *Caronia* [*Gaudryina*] suggesting high-energy, shallow-shelf environments of deposition.

The mudstone member of the Joli Fou Formation consists of grey shales or mudstones that are generally non-bioturbated but contain some beds with *Chondrites* and *Planolites*. Very fine-grained sandy interbeds a few centimetres in thickness are common. In both the LR (188 to 190 m) and CR (221 to 225 m) cores, the lower part of the mudstone member is essentially barren of benthic foraminifera, is non-bioturbated, but contains fish debris. This section is presumed to be an anaerobic biofacies. Its stratigraphic position suggests that it is a regional expression of the Late Albian oceanic anoxic event 1C (Jenkyns, 1980). Above the anaerobic biofacies, to the upper contact with the Viking Formation, a new foraminiferal assemblage occurs, dominated by *Saccammina*, *Miliammina*, *Haplophragmoides*, and *Gravellina*. This assemblage suggests a regressive, shallow marine, low salinity environment of deposition. *Haplophragmoides gigas* is absent in this assemblage except for an anomalous, but abundant, occurrence at 217 m in the CR core. At least on a local basis, foraminiferal distributions indicate that standard zones of *H. gigas* and *M. manitobensis* (Caldwell *et al.*, 1978) require refinement to take into account increased biostratigraphic resolution.

The Viking Formation has a uniform thickness of 18 or 19 m in the FG, LR, and CR cores. The lowermost Viking beds in the LR and CR cores consist of alternating very fine-grained muddy sandstone and laminated silty shales (60:40 ratio), mostly intensely bioturbated (*Chondrites*, *Terebellina,* and *Teichichnus*). In FG, thicker sands (up to 2 m) and shale or mudstone intervals characterize the lowermost Viking beds. In the middle part of the Viking in the FG core, a shaly interval contains two fine-grained dense layers of possible kimberlitic material 10 and 15 cm thick. The beds also contain quartz grains, fish debris, and possible diamond indicators (garnets?). If correctly identified, this is the only occurrence of kimberlite and indicator minerals yet found in the cores to the southeast of the Fort-à-la-Corne area. They probably represent a marine-reworked airfall deposit or the distal extension of marine-reworked kimberlite from the Fort-à-la-Corne area, only 20 km to the northeast. In the LR and CR cores, these middle mudstone beds of the Viking contain a foraminiferal assemblage dominated by *Saccammina*, *Miliammina*, and *Verneuilinoides* typical of a marginal marine, perhaps lagoonal, environment. The upper part of the Viking is sand rich in all three cores, but significant differences exist in the internal stratigraphy between the cores. For example, sandstone in the upper part of the Viking in CR contains terrestrial microfossils (megaspores, coal, amber), whereas the upper sandstones in the LR core contain marine microfossils representing the early transgressive part of the overlying marine cycle. Work on the sequence stratigraphic relationships in these rocks is currently in progress, but a preliminary sketch of the sequence boundary within the Viking Formation relative to the Smeaton kimberlite section is shown in Figure 3.

The Westgate Formation is predominantly made up of shale and mudstone 22 to 30 m thick. A 1 or 2 m thick bioturbated sandy unit typically occurs in the lower half of the formation. Most of the mudstones and fine sandstones or siltstones of the Westgate are slightly to moderately bioturbated (*Chondrites*, *Terebellina*, and *Teichichnus*, with possible *Planolites* and *Helminthopsis*). The lower contact with the Viking Formation occurs at a transgressive lag (flooding surface) that can be recognized in all four cores. Benthic foraminifera of the Late Albian *Miliammina manitobensis* Zone are abundant above the flooding surface and provide a record of transgression and regression through the Westgate (McNeil and Gilboy, 1999; McNeil *et al.*, in press). An anomalous occurrence of the *Verneuilinoides perplexus* Zone in rubble at 181 m in the CR well led to the erroneous placement of the upper boundary with the Fish Scales Formation (sequence boundary) at 181.9 m. The

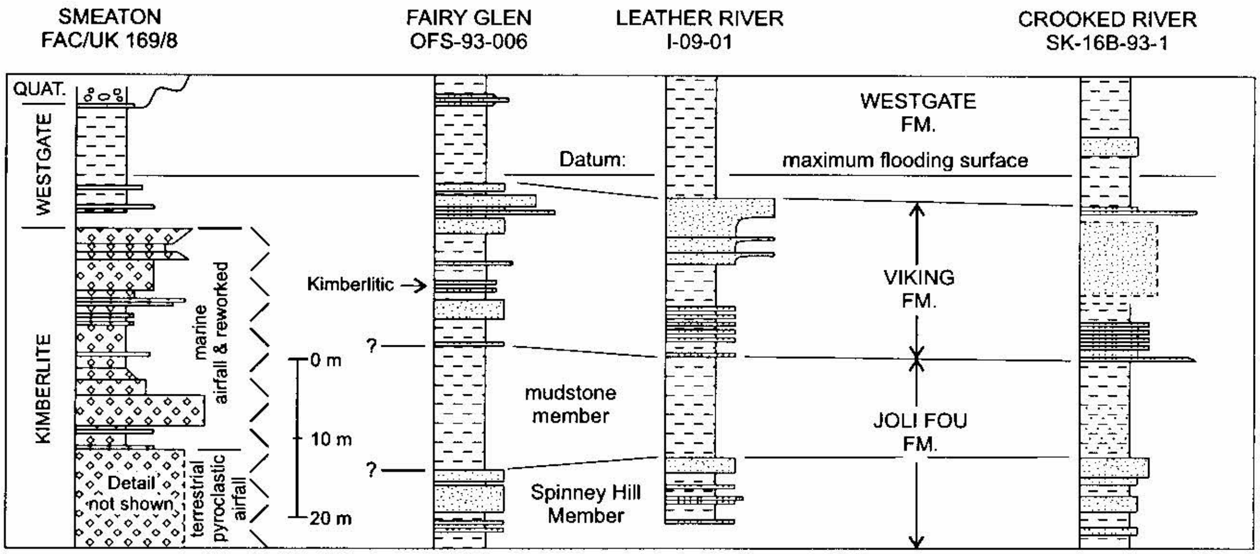

Figure 3 - Stratigraphic position of kimberlite rocks in the Smeaton FAC/UK 169/8 core relative to Cretaceous stratigraphic units in the Fairy Glen, Leather River, and Crooked River cores. The maximum flooding surface within the lower Westgate Formation is drawn on the basis of microfossil data. A radiometric age of 101.1 ±2.2 Ma in the lower part of the kimberlite succession suggests that the kimberlites are of Viking age.

correct contact between the Westgate and Fish Scales occurs at 172.5 m in the CR core as originally designated by Gilboy (1997). Resolution of the foraminiferal distributions and zonation through this section is currently in progress. Age assignments might also be revised considering: 1) McNeil and Caldwell's (1981, Figure 9) correlation of the upper Westgate with the Mowry Shale, and 2) revision of the Albian-Cenomanian to the base of either the *Neogastroplites cornutus* or *N. haasi* Zone (Cobban and Kennedy, 1989; Obradovich, 1993). This would place the Albian-Cenomanian boundary at about the middle of the Westgate Formation, rather than at its historical position at the base of the Fish Scales marker in the Western Canada Sedimentary Basin.

b) Fish Scales Formation to Pembina Member, Pierre Shale

Strata of the Fish Scales Formation through to the Pembina Member of the Pierre Shale form a stratigraphic wedge that thins northwestward due to the combined effects of unconformities and stratigraphic condensation towards the Fort-à-la-Corne kimberlite field. This unconformity-riddled wedge thins from about 52 m in the Crooked River core to about 18 m in the Fairy Glen core. Lithostratigraphic and biostratigraphic work, essential to the interpretation of these units, is still in progress, so their stratigraphic relationships are only briefly touched on here. The wedge is part of a regional thinning (Figure 4) of the Upper Colorado Subgroup towards central Saskatchewan (Williams and Burk, 1964, Figure 12-9). It is also consistent with a dome-shaped structural high in the Fort-à-la-Corne area (Simpson, 1982, Figure 37), and a weak structural high on a regional cross-section through central Saskatchewan (Hutt, 1963). Similar stratigraphic relationships have been documented from the Saskatoon area by North and Caldwell (1975). Using foraminiferal biostratigraphy, they documented unconformities beneath both the First and Second White Specks formations in the potash cores to the east and west of the Saskatoon area. This indicates that a

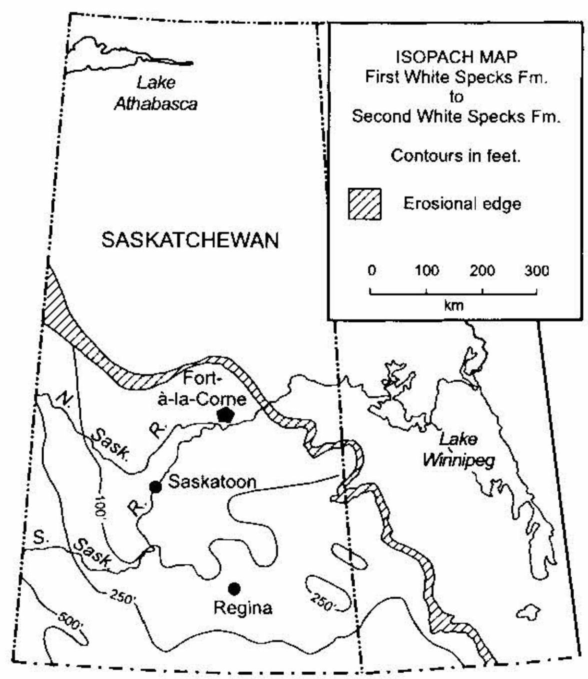

Figure 4 - Isopach map of the First to Second White Specks formation in Saskatchewan and southwestern Manitoba (redrawn from Williams and Burk, 1964). Note contour intervals are in feet.

regional southwest-northeast structural high may have extended from the Saskatoon area to the Fort-à-la-Corne area.

The Fish Scales Formation consists of shales, siltstone, and very fine-grained sandstones, locally calcite-cemented, with a sand/shale ratio of approximately 50:50. Fish debris is typically concentrated along bedding planes. In the LR core, the Fish Scales Formation consists of three coarsening-upward cycles. The formation thins steadily northwestward from 3.7 m in CR to 1.25 m in FG where thin siltstones and sandstones make up the entire unit. The lower contact is sharp with pyrite-filled burrows in the LR core and is a regional sequence boundary in the Western Interior. Its upper contact is unconformable with the overlying Belle Fourche Formation.

Stratigraphic and sedimentological interpretations of the Fish Scales beds are only gradually unfolding despite their having been recognized as a regional marker for decades (Gleddie, 1954). McNeil (1984) considered them to represent a basin-wide shoaling event with clastics transported into the basin from west and east. The Fish Scales sandstones in Manitoba and eastern Saskatchewan correlate with the D sandstone tongue of the Dakota Group extending into the Graneros Shale in the Denver Basin (McNeil, 1984). Leckie *et al.* (1992) recognized three units in the Peace River area: a lower bioturbated unit with terrestrial organic matter, a middle unit formed during rising sea level with anoxic substrates rich in fish debris, and an upper organic-rich unit with progressively more clastic sediment upsection. This description matches generally with the stratigraphic section in the FG, LR, and CR cores which consists of the distal, basinal representation of the Fish Scales beds condensed over a regional high in central Saskatchewan. The anoxic unit probably represents an Early Cenomanian regional oxygen-depletion event similar to that described by Kauffman and Hart (1996).

The Belle Fourche Formation is apparently unconformity bounded and thins from 5.7 m in Crooked River to 2.2 m in Fairy Glen. The "X" bentonite, 50 cm thick in the CR core, occurs at about the middle of the formation along with the thin, calcarenitic *Ostrea beloiti* beds. The *Verneuilinoides perplexus* Zone occupies the lower part of the Belle Fourche in the CR core. In LR and FG cores, however, an unconformity cuts out the lower half of the Belle Fourche and, as a result, the "X" bentonite lies directly on the Fish Scales Formation and *V. perplexus* Zone is absent.

The Second White Specks Formation (Favel Formation) unconformably overlies the Belle Fourche in all three cores (FG, LR, CR) and contains the planktonic foraminiferal zone of *Hebergella loetterlei*. In the LR core and probably the FG core, however, the lower part of the *H. loetterlei* Zone (i.e. the *Clavihedbergella simplex* Subzone) is absent by unconformity. Thin limestones (5 to10 cm) in the formation are probably the Laurier Limestone beds, which correlate with the Bridge Creek Limestone in the U.S. Western Interior and represent maximum flooding of the Early Turonian Greenhorn sea, hence their widespread distribution and preservation. The upper contact is unconformable with the First White Specks Formation in LR and CR, and data from the FG are presently not available.

The Morden Shale, although recorded in the CR core by Gilboy (1997) and McNeil and Gilboy (1999), has not been verified in the LR and CR cores by paleontological analysis. Foraminiferal data indicate that the First White Specks Formation in LR, for example, lies directly on the Second White Specks (Figure 2). In Crooked River, however, a sandstone unit is present between the First and Second White Specks formations. This unit occupies the same stratigraphic position as numerous Western Interior sandy units including the Late Turonian–Early Coniacian Cardium Formation in Alberta, the Late Turonian Turner Sandstone Member of the Carlile Formation in the Black Hills area, and the late Middle Turonian Codell Sandstone Member, Carlile Shale, in Kansas. The sandstone contains agglutinated foraminifera, numerous bentonites, burrows of *Condrites* and *Terebellina*, and traces of fusain. Further work on its age, sedimentology, and origin are in progress, but it no doubt represents a major regressive event and contains a major sequence boundary in the WCSB.

The First White Specks Formation (Niobrara Formation) thins from 21 m in CR to 15.3 m in LR (Figure 2), but its lower contact in FG has yet to be identified using paleontological data. Its lithology consists of white speckled shale, in places highly calcareous, with fish remains, thin bentonites, and mollusc shell fragments. A variety of "Niobrara" foraminifera are present, including planktonics and both agglutinated and calcareous benthics, but foraminiferal distributions are discontinuous in the LR and CR cores and many samples were barren. The variations in fossil content suggest a complicated depositional history, perhaps affected by regional or oceanic anoxic events, facies changes, or erosional episodes, which have yet to be resolved for this area of the Western Interior Basin. A major regional unconformity affects the uppermost White Specks Formation, as documented by Williams and Baadsgaard (1975) in southeastern Saskatchewan and McNeil (1984) in the Manitoba Escarpment.

The Gammon Ferruginous and Pembina members of the Pierre Shale occur only in the Crooked River core and are difficult to separate due to lithological similarities and poor fossil recovery. The Pembina Member is documented in the CR core (122 to123 m) by the occurrence of *Bathysiphon vitta* with a distinctive black organic coating common on the exterior of its test. Typical of the Pembina, numerous bentonites occur in the CR core. In the FG and LR wells, both the Gammon Ferruginous and Pembina members are cut out by an unconformity. A similar unconformity occurs at this stratigraphic level in the Manitoba Escarpment as illustrated by McNeil and Caldwell (1981) and McNeil (1984).

c) Millwood/Odanah Members, Pierre Shale

The uppermost Cretaceous strata in the FG, LR, and CR cores are assigned to the undivided Millwood/ Odanah members of the Pierre Shale. This undivided unit is 80 m thick in the Crooked River core, but the upper contact was not cored. Its lithology is remarkably uniform consisting of pale grey mudstone to darker grey shale. Sideritic concretionary layers of 4 to 10 cm in thickness are common, as are *Chondrites* burrows, fish remains, and mollusc shells. The Millwood-Odanah contact might occur at 107.5 m in the CR core where there is a change in the benthic foraminiferal assemblage. Core from 107.5 to 116 m contains a variety of agglutinated foraminifera including *Spiroplectammina* sp., as well as the calcareous benthic *Gavelinella pertusa* which occurs in the Millwood Member in the Manitoba Escarpment (McNeil and Caldwell, 1981). In CR core, above 107 m, the foraminiferal assemblage is relatively uniform consisting of *Bathysiphon*, *Ammodiscus*, *Glomospira*, *Haplophragmoides*, and *Dorothia*, an assemblage which suggests relatively deep water. Interpretations on the Millwood/Odanah are sketchy at present, as further research on its biostratigraphy and geochemistry is in progress.

5. Summary of Current and Ongoing Work

The lithostratigraphic and biostratigraphic work that has been presented briefly in this report, combined with previous geological studies in the Fort-à-la-Corne area (e.g. Leckie *et al.*, 1997), is sufficient to establish the stratigraphic position of kimberlitic anomalies relative to Cretaceous rocks of the Fort-à-la-Corne area. The events that led to the Late Albian kimberlite explosion (Smeaton location) apparently had little affect on the Cretaceous sedimentary strata to the southeast of the Fort-à-la-Corne area, as units show no particular modification in thickness or character in the direction of the kimberlites. Possible evidence of kimberlitic activity occurs 20 km from the southeast margin of the Fort-à-la-Corne kimberlite field within the Viking Formation in the Fairy Glen core as indicated by indicator minerals (garnets?) and thin dense rocks of apparent kimberlitic origin. This stratigraphic position is consistent with a previously reported age of 101.1 ±2.2 Ma from the Smeaton kimberlite (Leckie *et al.*, 1997), and the general recognition that the majority of the volcanism at Fort-à-la-Corne occurred in the time interval from 99 to 101 Ma (Kjarsgaard, pers. comm., 2000). Although the kimberlitic beds in the Viking are very thin, it is possible that thicker and more numerous beds could occur closer to the kimberlite occurrences. Concentrations of indicator minerals and diamond occurrences in marine reworked kimberlite at the Smeaton locality (Leckie *et al.*, 1997) make this facies a potential target for further diamond exploration.

The convergence of unconformities and condensed sections in Cenomanian to earliest Campanian strata towards the Fort-à-la-Corne kimberlite fields might be related to regional tectonic uplift in central Saskatchewan, rather than kimberlitic events *per se*. The pattern of condensation follows regional trends recognizable over a broad area of central Saskatchewan trending from the Fort-à-la-Corne area southwest through the Saskatoon area. Many of the unconformities are recognized also in the Manitoba Escarpment and elsewhere in the Western Interior Cretaceous Basin, emphasizing a regional, rather than local, control. However, this does not rule out the possibility of uplift in the Fort-à-la-Corne area during or prior to kimberlitic activity.

Further work on the biostratigraphy and geochemistry of these cores will document the unconformities and the internal stratigraphy and contents of the condensed strata. A thorough sequence stratigraphic analysis of the entire section will establish these cores as important reference sections at the geographic centre of North American, near the northeastern erosional edge of the Cretaceous System.

6. Acknowledgments

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