SEDIMENTATION AND STRATIGRAPHY

OF PART OF THE

RICE LAKE GROUP, MANITOBA.

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by
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ABSTRACT

The extrusive and volcanic-derived sedimentary rocks of the Rice Lake Group, Manitoba, have been subdivided into eight formations. These units are named and identified here for the first time.

Sedimentary rocks within the lower part of the group were deposited in a rapidly subsiding basin, with syn-depositional volcanic activity.

Three lithofacies have been delineated within the group. They outline the proximal, transitional, and distal facies. These three are persistent throughout the stratigraphic column. Their stratigraphic persistence shows that volcanic activity was localized and consistent throughout the history of the basin. The distribution of the facies is used to delineate their respective sources. At least two volcanic sources have been delineated in this manner, one in the western part of the basin, and the other in the southeast. Size analyses of conglomerate clasts indicates that the fragments have undergone at least one sorting cycle prior to their final deposition.

Primary sedimentary structures typical of turbidites occur throughout the lower part of the stratigraphic sequence and indicate that the major mechanism of deposition was by turbidity currents. Large amounts of coarse detritus deposited in the basin, prior to the extrusion of the basalts, are inter-

preted as a direct consequence of paleoseismic shocks on unstable sediments.

Differentiation of the parent magma at depth is reflected in both the volcanic products, and in the upward increase in the percentage of detrital quartz in the derived sand-sized sediments.

Welded tuffs and agglomerate clasts close to one source show that deposition was at least in part subaerial during the late stages of basinal development. Iron formation deposited during the later history of the basin marks major chemical changes — involving Eh and pH. The iron formation is relatively thin and discontinuous in the proximal facies, but becomes a major unit eastward, in the distal facies.

Rocks within the area have undergone at least two, and possibly three, periods of subsequent deformation.

The geometry of the basin of deposition can be approximated by noting regional variations in the gross lithology and texture of the sediments. Water depth at the sites of deposition may be inferred from some of the lithologic associations.

Sources of sedimentary material can be delineated from the paleocurrent pattern, changes in lithology, and clast size variations. Two possible volcanic sources have been located in this manner.

Correlation of the sediments and volcanic rocks in the vicinity of Rice Lake area with those of the Beresford Lake area

is very tenuous, as the Ross River quartz diorite pluton has obliterated much of the original lithologic correlation. However, the stratigraphic succession in each locality is quite similar, and a tentative correlation is proposed.

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CHAPTER 1

INTRODUCTION

Statement of Problem

The purpose of this project is to produce a detailed reconstruction of the depositional history, stratigraphic succession, and depostional environment of part of the Rice Lake Group.

The area of detailed study is situated east of Bissett, and comprises most of Twp. 22, R. 16, and part of Twp. 23, R. 16, (see figure 1). The sedimentary rocks at Rathall Lake in Twp. 20, R. 17 were also examined in detail in an attempt to determine their stratigraphic relationships.

The consolidated rocks of the area are all Precambrian. Turek and Peterman (1967, 1971) and Ozard and Russel (1971) have determined numerous Rb/Sr dates for the rocks in this area, but these are all associated with intrusions, and periods of metamorphism.

The predominant structure in the area is a large dome with a northwest-trending axial plane. A small syncline and anticline on the southwestern flank of this dome have been faulted along their common limb.

A penetrative foliation is locally developed and is the most pronounced small-scale structural feature. These sediments have undergone very little post-depositional deformation, and primary sedimentary structures are extremely well-preserved.

Field work was conducted for three weeks in 1967, and for

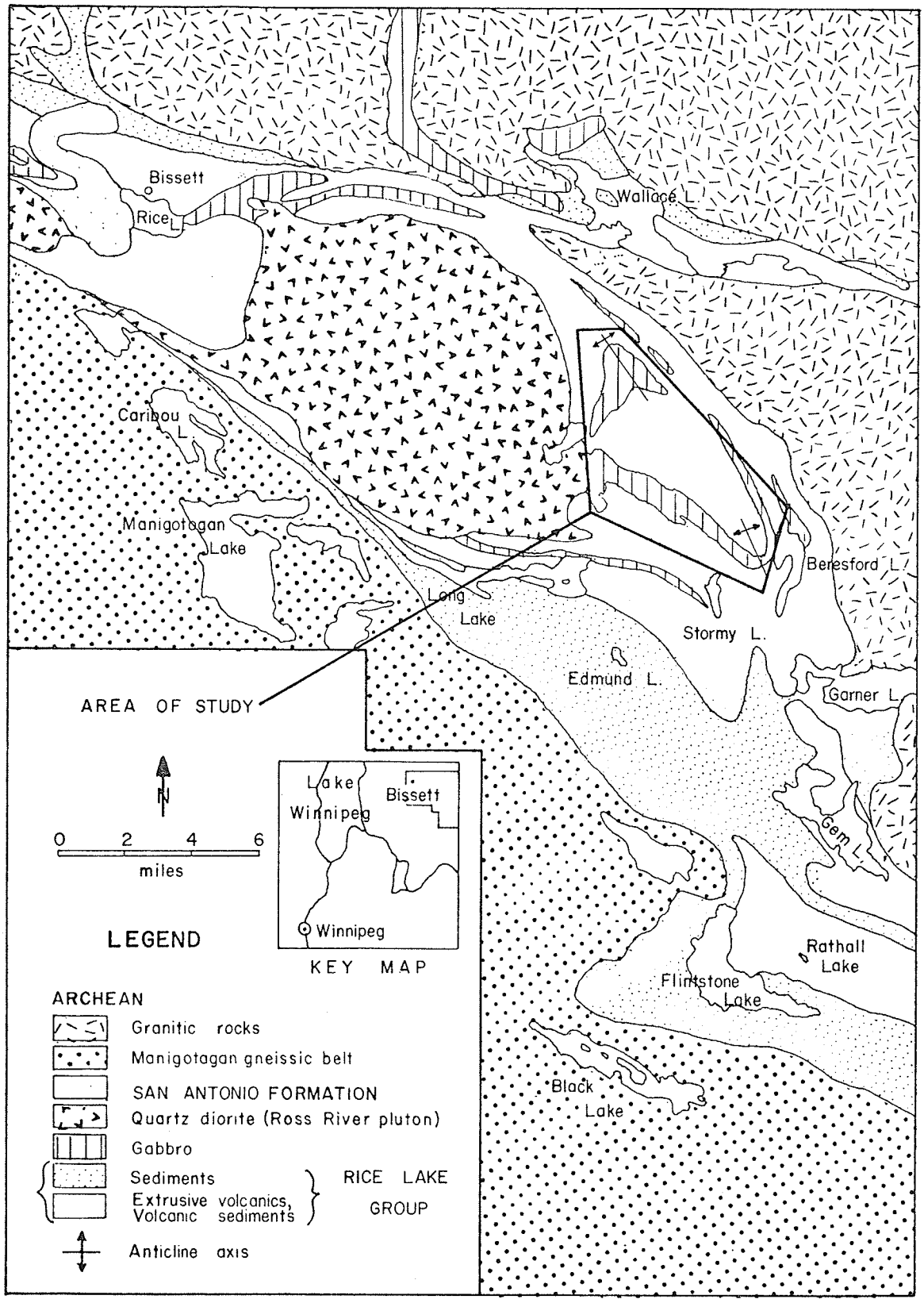

Figure 1 Location map and area of this study.

the entire field season in 1968. The majority of the field work was carried out by pace and compass traversing, with helicopter support for inaccessible areas.

This study has led to the subdivision of the major lithologic units into formations; eight new formation names are proposed and defined for the first time. Detailed examination of field relationships and thin sections has resulted in a subdivision of some of the formations into informal units.

The stratigraphic succession, mineralogy, texture, and form of the sedimentary units indicate that the extrusive and sedimentary units of the sequence are closely interrelated, spatially, temporally, and genetically. Evidence is presented to indicate that periods of extrusive volcanism were followed by periods of quiesence accompanied by sedimentation. Sedimentation was abruptly terminated by fresh outpourings of basalt. In each case, however, the beginning of extrusion is reflected by marked textural changes in the sediments.

The shape of the basin of deposition was studied by noting regional variations in the gross lithology and texture of the sediments.

Sources of sedimentary material in the basin were delineated from paleocurrent patterns, changes in lithology, and clast size variations.

Previous Work

Moore, 1912, first mapped the rocks of the Rice Lake area and subdivided the rocks west of Rice Lake into two series:

(1) The Wanipogow Series, predominantly sedimentary in origin, and

(2) The Rice Lake Series, predominantly volcanic in origin.

He believed the Wanipigow Series rested unconformably on the Rice Lake Series.

Cooke, (1921), mapped a small area around Rice Lake, and combined the rocks into one unit, which he termed the Rice Lake Series.

Wright (1922, p. 45) subdivided the rocks of the Rice Lake Series into three units. From oldest to youngest, these are:

(1) Predominantly volcanic rocks,

(2) Probable sedimentary series, schists,

(3) Predominantly sedimentary rocks — arkose, conglomerate.

Wright, (1925), applied names to these, but with a change in the stratigraphic succession. From oldest to youngest:

(1) Manigotagan Series — schists,

(2) Wanipigow Series — greywacke, arkose, conglomerate,

(3) Rice Lake Series — basic volcanics, minor greywacke.

Wright, (1927), subdivided the Rice Lake Series into three phases, corresponding lithologically to the previous three units. However, these do not correspond to either of the previous two subdivisions by Wright (1922, 1925). The three phases are:

(1) Manigotagan Phase,

(2) Beresford Lake Phase,

(3) Wanipigow Phase.

Wright appeared undecided about the position of the Manigotagan Phase in the sequence. In 1932, he assigned these rocks to the Rice Lake Series, and retained the stratigraphic succession he proposed in 1927 (ref. cit.).

Stockwell, (1937), named the rocks in the Rice Lake area the Rice Lake Group. He noted that some of the sedimentary rocks of the area were interbedded with the volcanic rocks and that other sedimentary units, west of Rice Lake, overlay the volcanics with marked unconformity. Stockwell named the overlying sediments the San Antonio Formation (Stockwell, 1937, p. 3). He noted that the San Antonio rocks were not cut by any intrusives, and they appeared to be younger than the large quartz diorite body to the east. He was, however, not convinced of the relationship.

Davies, (1963), concurred with the stratigraphic succession proposed by Stockwell for the Rice Lake Area. He delineated the unconformity between the San Antonio Formation and the Rice Lake Group, confirming Stockwell's original interpretation.

CHAPTER 2

STRATIGRAPHY

The stratigraphic terminology of the rocks within the area has varied considerably. Figure 2 presents a summary of the stratigraphy to date, and the revised stratigraphic succession proposed by this writer. The writer proposes to name and define the following units, from oldest to youngest:

U.T. Basalt (informal name)

Stovel Lake Formation,

Tinney Lake Formation,

Dove Lake Formation,

Gunnar Formation,

Stormy Lake Formation,

Rathall Lake Formation (Stratigraphic position unclear)

The Narrows Formation,

Edmunds Lake Formation

These units present the most detailed subdivision of the rocks to date. The units are defined, in order, in the following section.

U.T. Basalt (informal name)

This unit outcrops only in the core of the major anti-