Paper 1

The Inferred Hydrogeology of Lake Gregory

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INTRODUCTION

The purpose of this paper is to review the available hydrogeological information relating to Lake Gregory. Examination of Geological Survey information reveals that there are very limited data and consequently comments on the hydrogeology are mainly inferred.

Climate

Lake Gregory has an arid climate with an average annual rainfall of about 250 mm. However, annual rainfall varies widely and is usually received in short intense events associated with thunderstorms or cyclonic activity.

The average annual evaporation is about 4000 mm, which results in surface water persisting for only short periods.

Physiography

Lake Gregory is situated at the terminal end of Sturt Creek and Djaluwon Creek (Fig. 1.1) and has a catchment area of about 65 000 km^2. Large streamflows have been observed in Sturt Creek but no stream gauging has been undertaken. A number of semi-permanent pools (water-holes) occur at some places along Sturt Creek and the drainages which link associated clay pans in the lower reaches of Sturt Creek before it enters Lake Gregory.

Lake Gregory is about 200 m above sea level and has an area of about 120 km^2. The bed of the lake is composed of clay with local development of salt and gypsum pans. The lake may remain filled with water for several years after stream flow.

GEOLOGY

Stratigraphy and structure

Lake Gregory is situated in the north-east Canning Basin, within the Gregory Sub-Basin (Fig. 1.2). It is underlain by up to 16 000 m of sedimentary rocks, ranging in age from Ordovician to Mid-Triassic, which are covered by a veneer of alluvium and lacustrine sediments believed to attain a maximum thickness of about 30 m.

The Ordovician to Mid-Triassic sediments are gently folded and may be incised by a palaeovalley to a depth of about 30 m and infilled by flat-lying alluvial and lacustrine sediments.

Sturt Creek is believed to form the headwaters of a large palaeoriver which once flowed westward across the Canning Basin to the Indian Ocean (Fig. 1.3). The river may have existed since the Eocene but in the Late Tertiary (Mid-Miocene), when the climate changed from humid to arid, alluvial sediments choked the drainage and were subsequently partially covered by seif dunes. Only the headwaters of the drainage system remained active.

HYDROGEOLOGY

Water table

A regional water table (unconfined groundwater) is believed to extend throughout the region within the alluvium (where sufficiently thick) and in the weathered uppermost part of outcropping Permian and Triassic sediments. Depending on elevation the water table ranges in depth from about 20 m in upland areas to about 3 m or less at Lake Gregory. The configuration of the water table probably approximates the regional topography and flow probably converges on the area in the vicinity of Lake Gregory where the groundwater is discharged

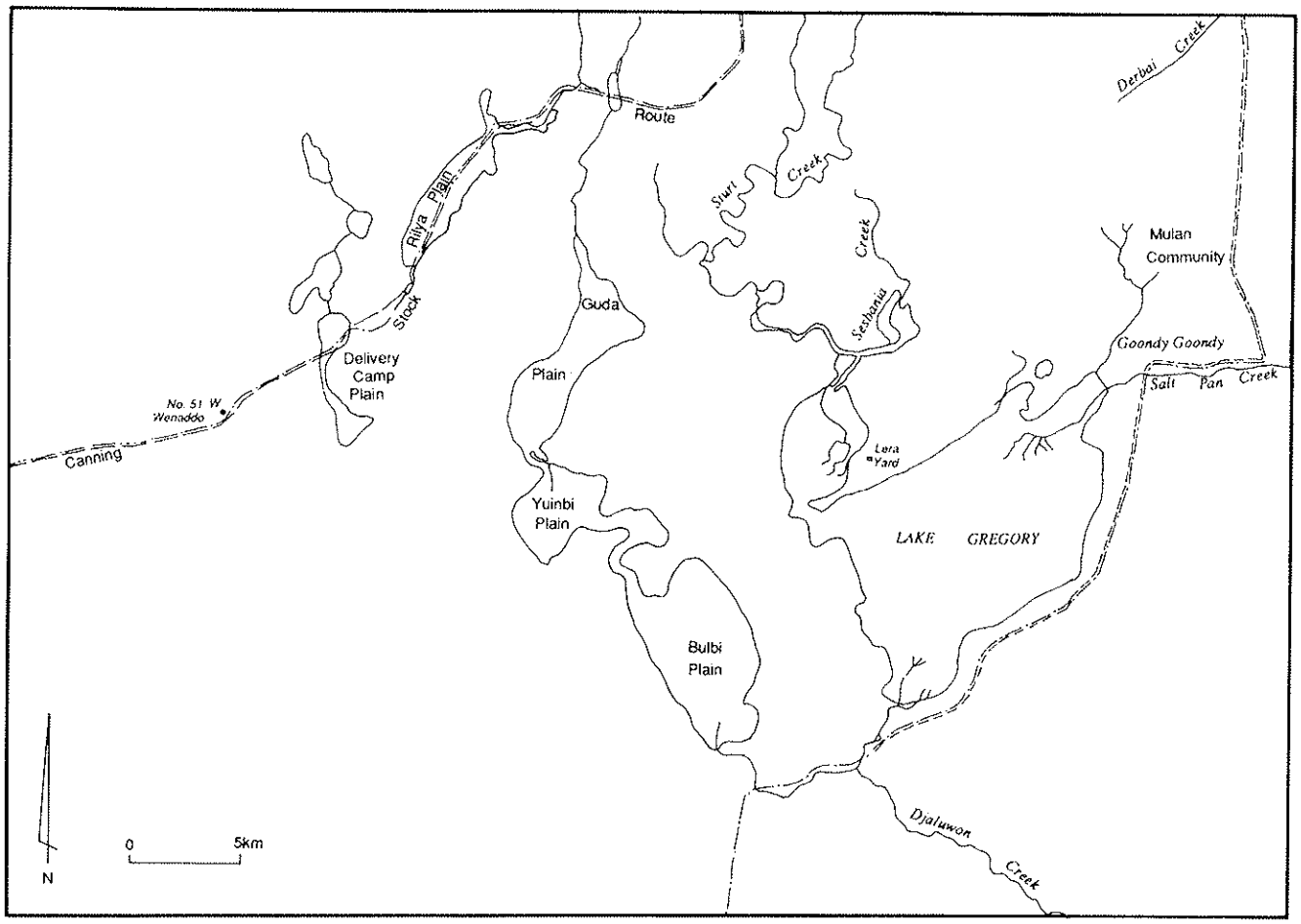

Figure 1.1

Location of the main features of the Lake Gregory system.

by evaporation from water-holes, evapotranspiration from vegetation, and possibly by sub-surface discharge. Groundwater is likely to increase in salinity toward Lake Gregory and is believed to be generally brackish to saline.

Confined aquifers

Sandstones in the Ordovician - Mid-Triassic sediments underlying the alluvial sediments contain confined groundwater flow systems, in which the directions of groundwater flow are unknown. The groundwater is believed to vary from brackish to saline.

Lake Gregory

Sturt Creek forms a delta-like system of distributory channels and clay pans before entering Lake Gregory. It is inferred that many of the clay pans may temporarily hold fresh to brackish water after stream flow. However, for most of the year surface water occurs only in overdeepened areas along distributory channels as semi-permanent water-holes which are presumed to be also maintained by some groundwater inflow when the water table is high.

The nature of the underlying Triassic sediments make it unlikely that there is subsurface input to, or leakage from, Lake Gregory that involves the confined aquifer. However, there is undoubtedly an input from the unconfined groundwater in alluvial sediments. It is also inferred that some sub-surface discharge of saline groundwater (and lake water) may occur via the palaeoriver channel as the development of salt is small when compared with some other salt lakes which occur in Western Australia.

The development of salt pans probably mainly represents a build-up of cyclic salt which is only partly flushed or removed by ablation from the lake surface.

CONCLUSIONS

(1) There is very limited hydrogeological information about Lake Gregory.

(2) The lake is situated in a 'delta-like' area at the end of an active drainage which formed the headwaters of an extensive palaeoriver system which formerly extended to the Indian Ocean.

(3) The lake is inferred to be maintained by surface inflow principally from Sturt Creek and by a minor contribution of groundwater from unconfined groundwater in alluvial sediments and weathered Permian-Triassic sedimentary rocks.

(4) Some subsurface discharge may occur from Lake Gregory.

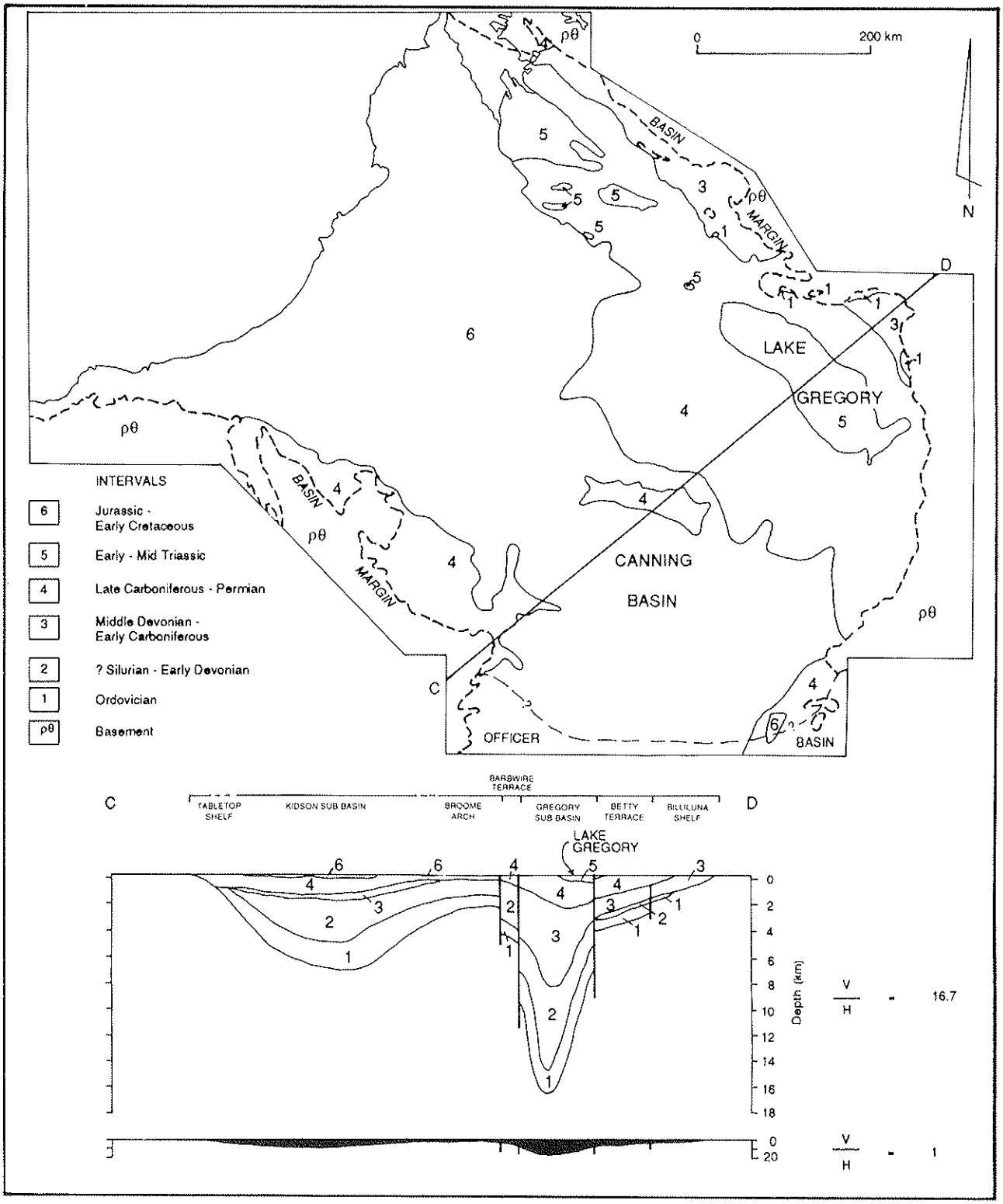

Figure 1.2

Transect (C-D) through the Canning Basin, including the Gregory Sub-Basin, showing the generalised geology of the region.

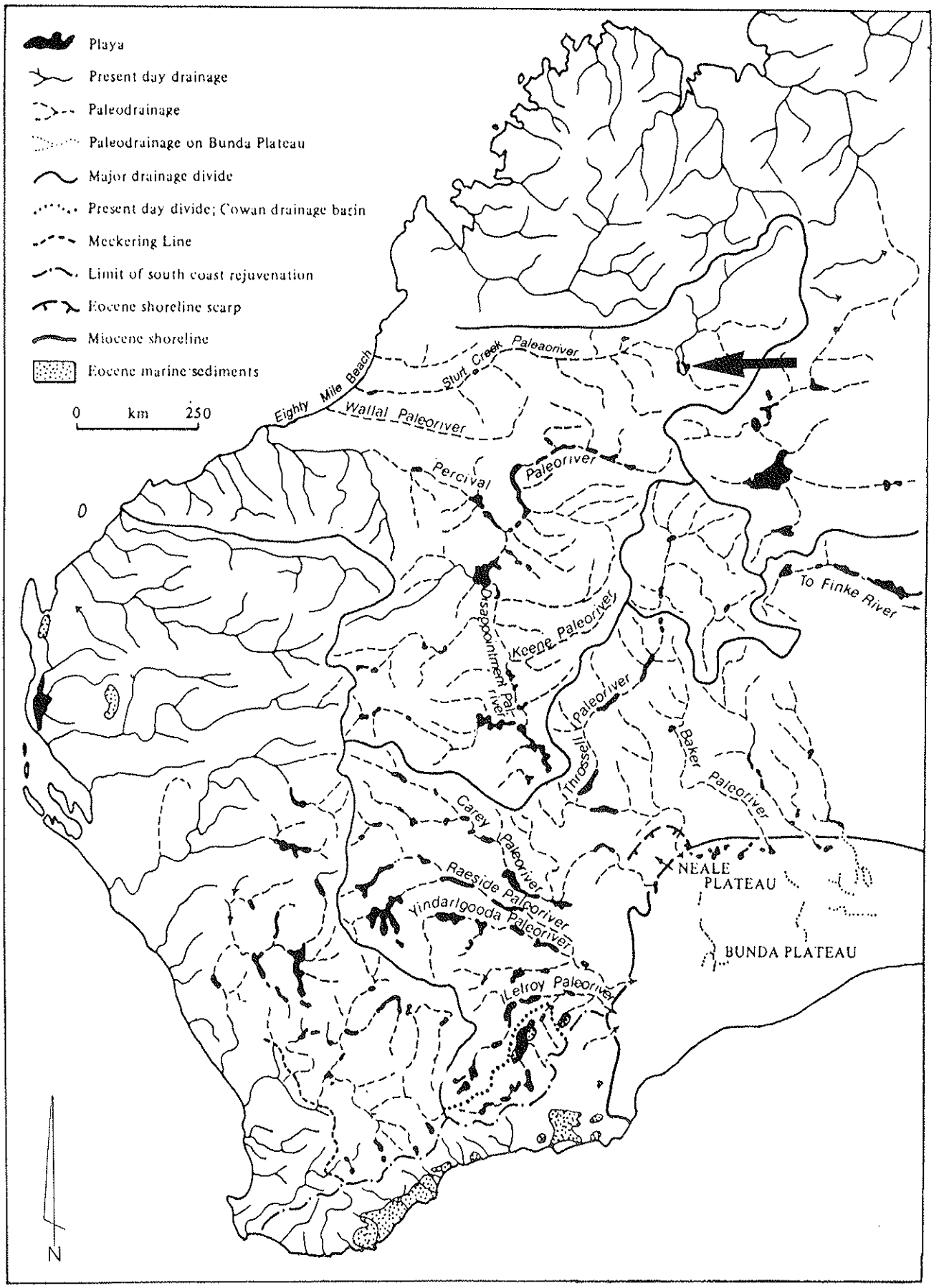

Figure 1.3

Present-day and palaeodrainage systems in Western Australia, including the Sturt Creek palaeoriver system. Lake Gregory is arrowed.