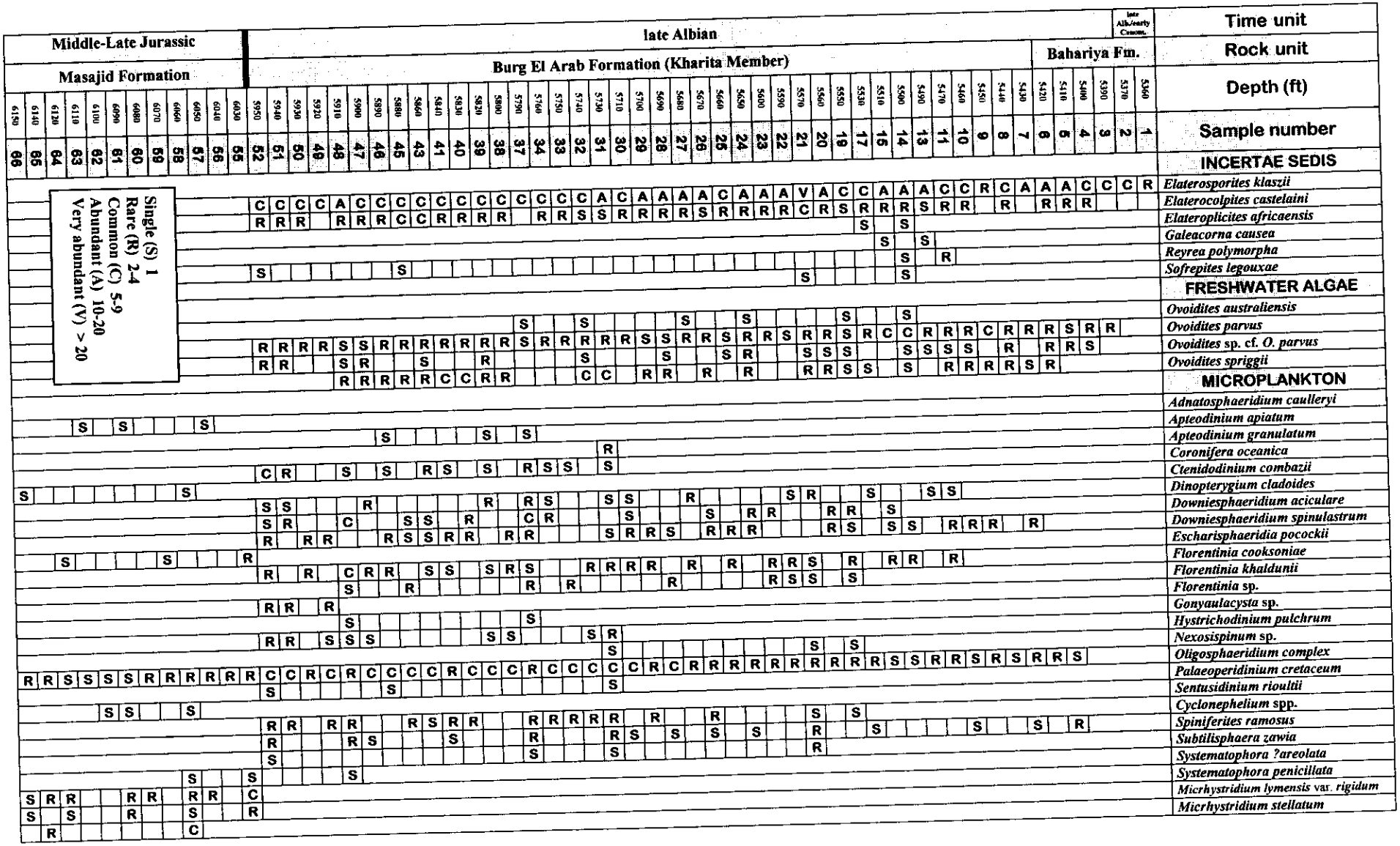


Figure 4.3. (continued).

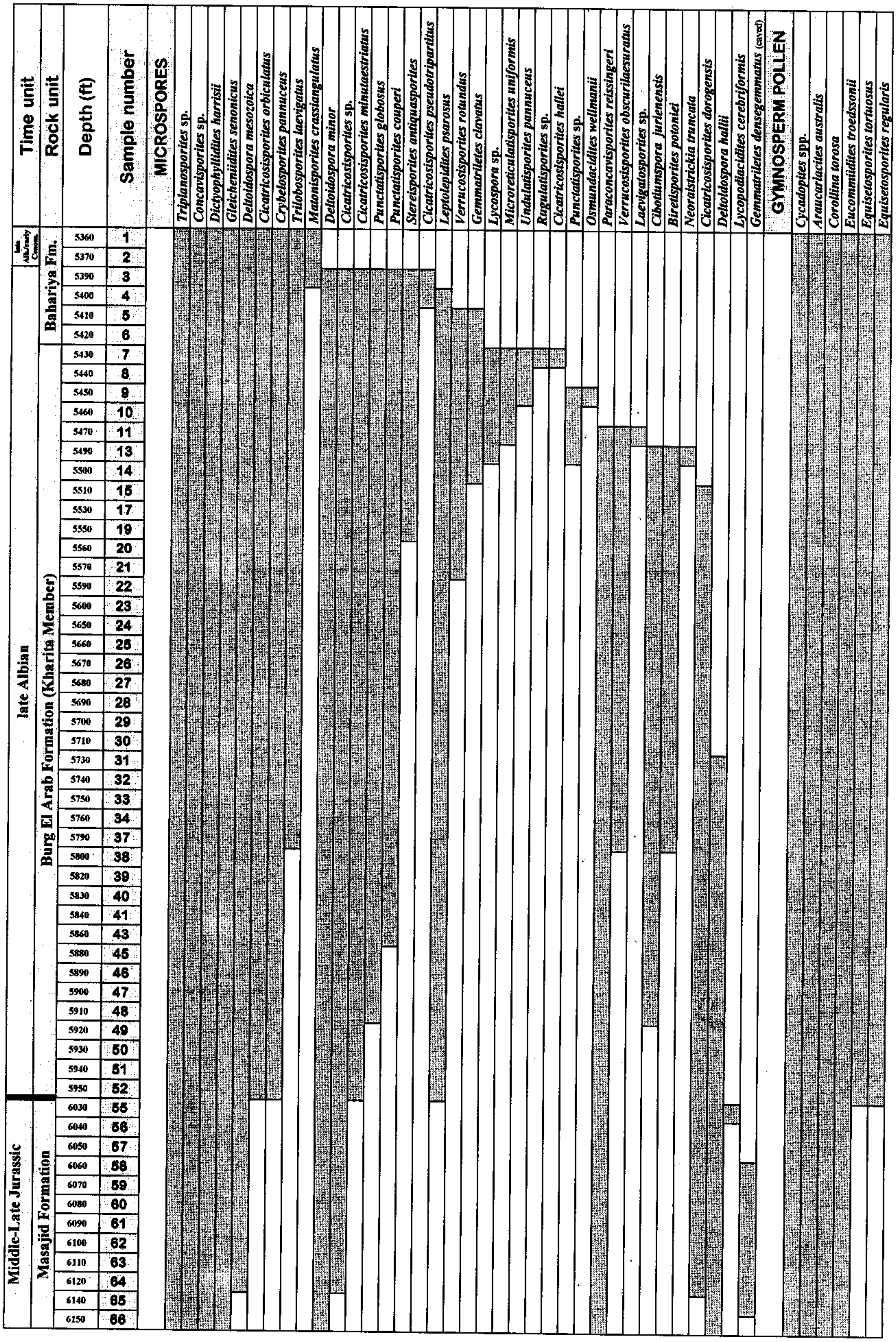


Figure 4.4. Stratigraphic distribution of the recorded palynomorphs in the studied interval of the Sharib-1X well.

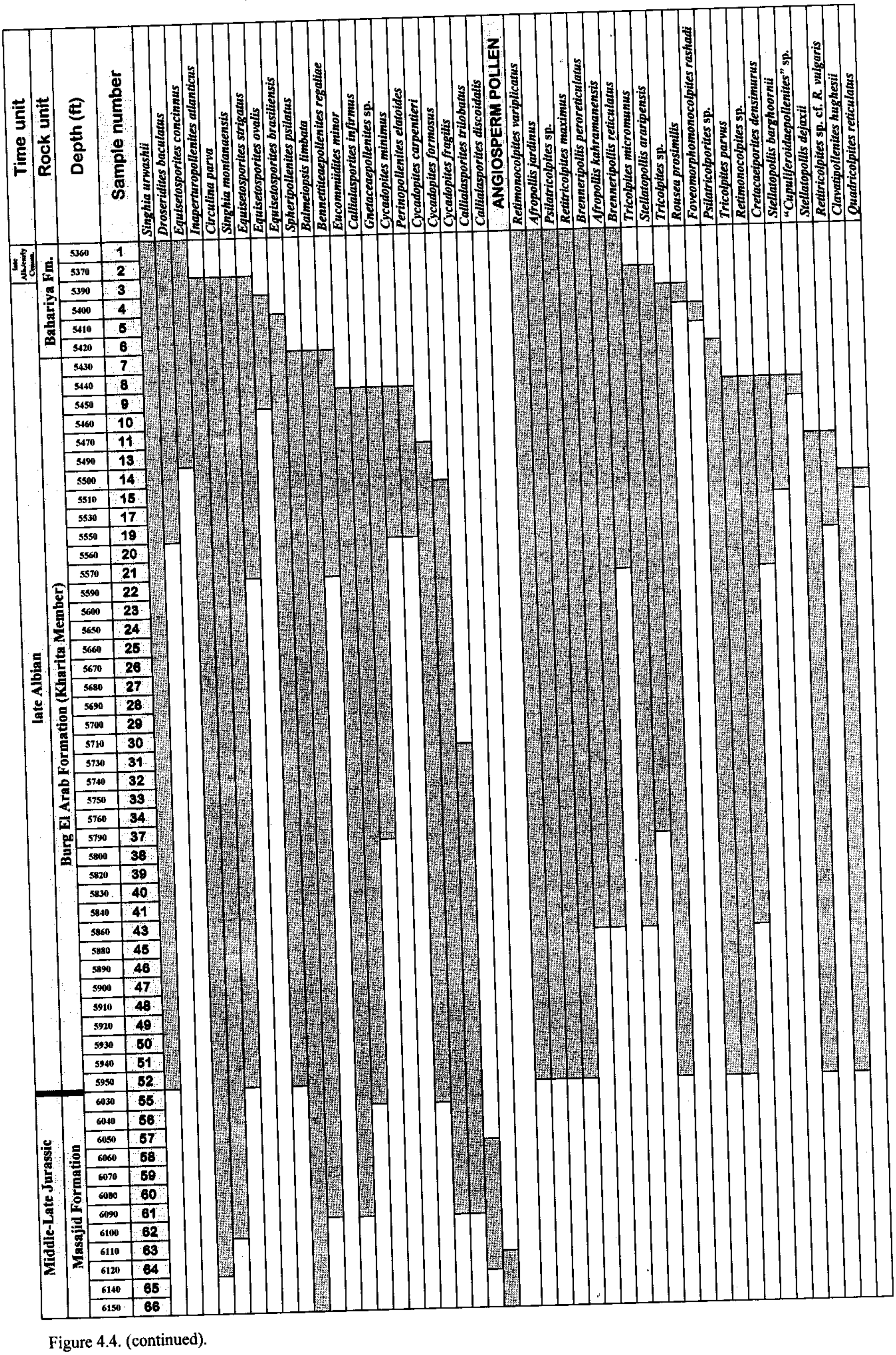


Figure 4.4. (continued).

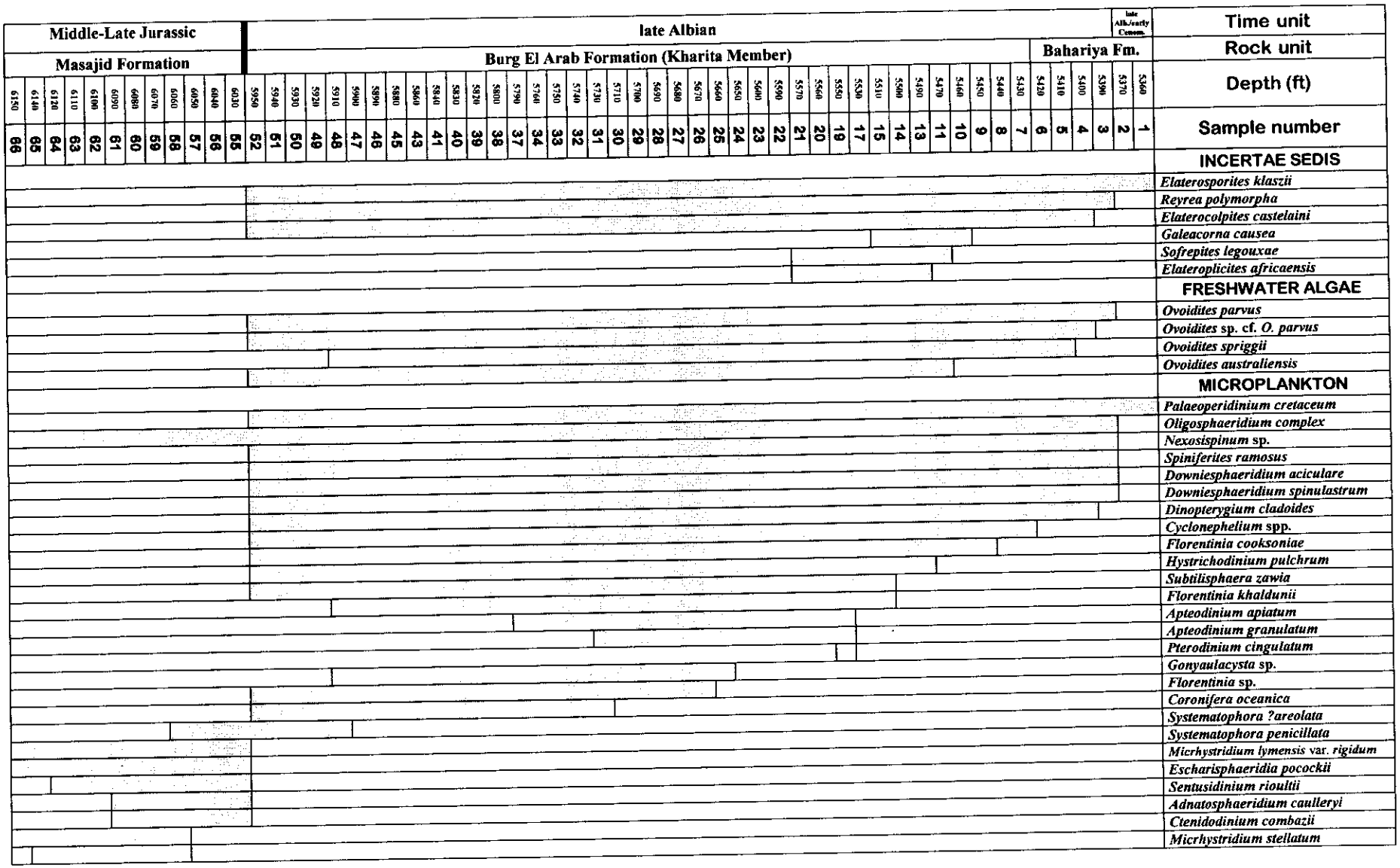
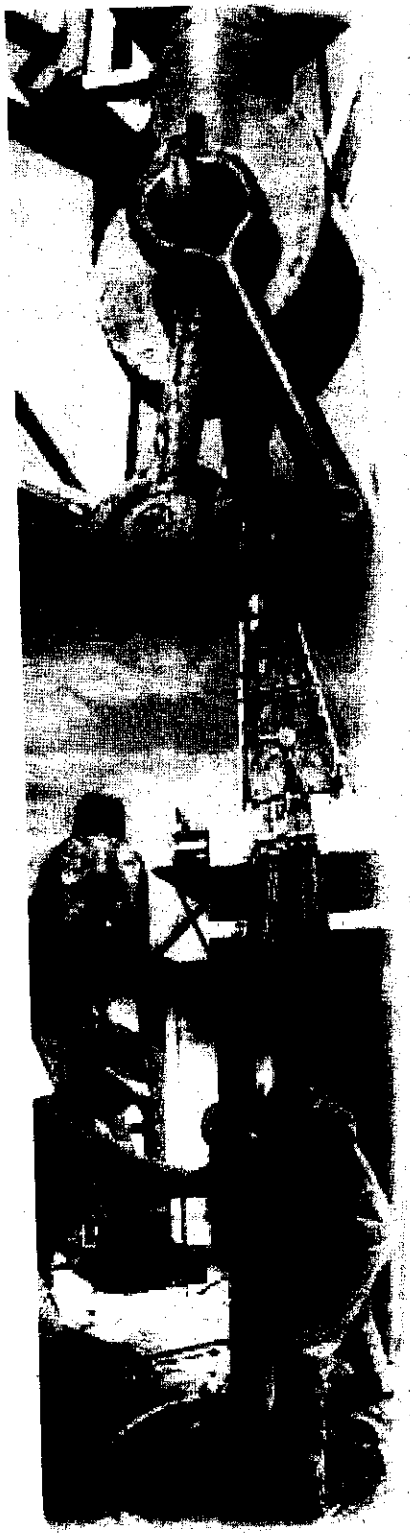


Figure 4.4. (continued).



CHAPTER V
PALYNOFACIES ANALYSIS, ORGANIC THERMAL MATURATION AND SOURCE ROCK EVALUATION

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Introduction:

The distribution patterns of palynomorphs and other particulate organic matter (POM) could be used for facies recognition and palaeogeographic reconstruction. Palynofacies is a term commonly used to describe the quantitative and qualitative palynological study of the total particulate organic matter assemblage contained in a body of sediment thought to reflect a specific set of environmental conditions, or to be associated with a characteristic range of hydrocarbon-generating potential (Tyson, 1993, 1995). This term was first introduced by Combaz (1964) to describe the total microscopic image of the organic components. Then it became popular however, the definition varied between different authors. Some authors named the organic components "organic matter", others "palynodebris" but still others "kerogen" (Carvalho, 2001).

The term kerogen is today the most commonly used term to describe the organic components contained in sedimentary rocks (Tyson, 1993). Tyson (1993) used the term kerogen in a purely palynological sense to describe the dispersed particulate organic matter of sedimentary rocks that is insoluble in hydrochloric (HCl) and hydrofluoric (HF) acids.

Palynofacies analysis involves the identification of individual palynomorphs, plant debris and amorphous components, their absolute and relative proportions, size spectra and preservation states. It is an interdisciplinary technique that forms the natural interface between palynology, sedimentology and organic geochemistry (Tyson, 1993).

Present work:

In the present study, kerogen assemblages are categorized into four main groups similar to those identified by Ibrahim *et al.* (1997). These include:

- **Palynomorphs**, refer to all structured HCl and HF resistant organic-walled microfossils.

- **Phytoclasts**, refer to all structured yellow to brown colour dispersed clay- to fine sand-sized particles of plant derived kerogen other than palynomorphs.

- **Opaques**, refer to all structured brownish black to black colour oxidized or carbonized particles of plant derived kerogen.

- **Amorphous organic matter** (AOM), refers to all structureless dispersed clay- to fine sand- sized particles of plant derived kerogen.

The simple classification mentioned in Tyson (1993, 1995) and Ibrahim *et al.* (1997) for rapid assessment of hydrocarbon potentialities may be used as follows:

1- Kerogen type I (highly oil-prone material): It includes alginitic material derived from chlorococcale algae, prasinophyte algae, cyanobacteria and some thiobacteria. Resins are the only significant terrestrially derived components belonging to this group.

2- Kerogen type II (oil-prone material): It includes amorphous organic matter, but sporopollenin palynomorphs, cuticle and non-cellular membraneous debris are also included.

3- Kerogen type III (gas-prone material): Orange or brown, translucent, phytoclasts or structureless materials. Woody fragments are typical.

4- Kerogen type IV (inert material): Opaque to semi-opaque, black, or very dark brown particles, representing oxidised or carbonized phytoclasts.

Methodology:

Ninety-three kerogen slides were prepared from the Sharib-1X (66 slides) and Ghoroud-1X (27 slides) wells. Each slide was examined using the transmitted light microscopy at X 200 and X 500 magnification in order to make a qualitative as well as a quantitative analysis of the particulate organic matter (POM), determination of the palynofacies and kerogen types, determination of spore colouration and assessment of Thermal Alteration Index (TAI), vitrinite reflectance (Ro %) and organic thermal maturation. Each slide was counted for its (POM) content, in which the first 200 particles were counted in terms of *abundant* (>35 %), *frequent* (16-35 %), *common* (5-15 %) and *rare* (<5 %) (cf. Ibrahim *et al.*, 1997).

Tables 5.2, 5.3. include the semi-quantitative distribution of the various (POM) recorded from the Sharib-1X and Ghoroud-1X wells respectively. Representatives of the studied (POM) are photographed and illustrated in plate 10, figures 8-12 and plate 11.

Palynofacies and kerogen types:

- **Sharib-1X well**

The studied interval in the Sharib-1X well from 5360-6160 ft can be classified into three major palynofacies types based on the abundance of the (POM) groups. These from youngest to oldest include:

A- Palynofacies 1 (phytoclast and opaque facies):

This facies is the youngest one and is located between 5360-5700 ft from Burg El Arab and Bahariya formations (Figure 5.5). It is characterized by abundant phytoclasts, frequent opaques, common amorphous organic matter (AOM) and common to rare palynomorphs (Figure 5.1).

The phytoclasts consist mainly of pale brown, well to moderately preserved structured terrestrial plant fragments (e.g., tracheids, cuticles, xylem ray tissues and fungal hyphae). Tracheids are the most common phytoclast constituent, mostly in the form of elongate lath-shaped particles lacking any visible pitting; conspicuous perforated bordered