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Research Article

PALYNOLOGICAL STUDY OF PALEOGENE, WEST IRAN

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ABSTRACT
This article is derived from one of the several investigations to study palynomorps and thermal maturity in the Zagros oil field, southwest of Iran. This section of Pabdeh formation consists of 21 dinoflagellate species. The species led us to define one Biozone. The dinoflagellate species correlation permitted precise age assignment of late Paleocene to early Oligocene for this section. For thermal maturity, excellent palynomorph's element is spore and pollen to record change color. The sample pointed in brown color that indicated oil prone. The paper presents a new study of the Paleogene dinoflagellate cysts from this area.

Keywords: *Zagros Basin, Pabdeh Formation, Dinoflagellate Cysts, Paleogene, Thermal Maturity*

INTRODUCTION
Twenty one dinoflagellate cyst species were identified from Pabdeh Formation in west of Iran. The Formation is known as the source rock for the eminent reservoir, Asmari Formation, which is extended through Zagros basin from southwest to southeast of Iran. The Pabdeh Formation beginning from Paleogene, shows different age ranges up to Oligocene in different parts of Zagros basin. In Fars and Khuzestan provinces the Formation has been dated as Paleocene to Oligocene while it is dated as Paleocene to Early Miocene in Lurestan province.
There was a trough in Paleo gene and Neo gene covering today's highlands to the Arabian shield in which strata were continuously deposited. This sea was separated by Fars platform in Southern Jahrom city. With some lithological differences such as the Rus anhydrite Formation in UAE, Qatar, Eastern Iraq, Kuwait and Hejaz, this trough extends to Arabia and Iraq. Equivalent strata to the Pabdeh Formation consist of Dammam Formation ontop, Rus anhydrite in the middle and Ommolradhome Formation at the base in countries to the south of Persian Gulf. The present study is focused on marine palynomorphs and palynostratigraphy of a sections of the Pabdeh Formation in Zagros basin in southwest of Iran.

Previous Research
No study has been done on dinoflagellate cysts from the Pabdeh Formation though vast and precise studies have been carried out on foraminifera contents of the formation by the National Iranian Oil Company (NIOC) (Motiei, 2003). General researches in Zagros basin suggest a Paleocene to Miocene age for the Pabdeh Formation but, this age range varies in different areas (Aghanabati, 2004). This Formation is a known source rock for the Asmari Formation, a huge reservoir rock in the Middle East and also the largest Carbonate reservoirs rocks discovered in the world (Ashkan, 1983). For this reason, most studies on Pabdeh Formation are associated to petroleum industries.

Geological Setting
The area selected for the present study is located in Southwest Iran, Zagros basin, Kohgiliyeh va Boyeramad province. One of the three sections studied for this article is located near Gachsaran between Choram and Bashtcity in this province as shown in Figure1.

MATERIALS AND METHODS
A total of 89 samples were processed with mineral acids in several steps taken according to palynological standard methods (Traverse, 1988). The processed amount depends on the lithology: for shale, mudstone and siltstone 20-25 grams; for limestone and calcareous shale30 -35grams, and for siltstone and mudstones 25-30 grams are common. For this study approximately 20-30 grams of rock samples were crushed and soaked in 30% Hydrochloric acid (HCl)for at least a day to remove calcareous cements and

particles. The residue was then washed with distilled water for 10 times to neutralize the acid. Then it was placed in Hydrofloric acid (30%) for 48 hours to remove Silicate compounds. Then, they were boiled for 20 minutes with Hydrochloric acid (10%) to remove the gel formed. To remove palynomorphs from heavy minerals and other wastes based on their specific weight, heavy zinc chloride solution ($Zncl_2$) was used and the residue was centrifuged. When the samples were passed through the 20 micron sieve, palynological slides were mounted from the residues remaining on the sieve. To analyze the palynological elements, the prepared slides were investigated with a binocular transmitted light microscope equipped with objectives of 10X and 40X and the index dinocysts were photographed and presented.

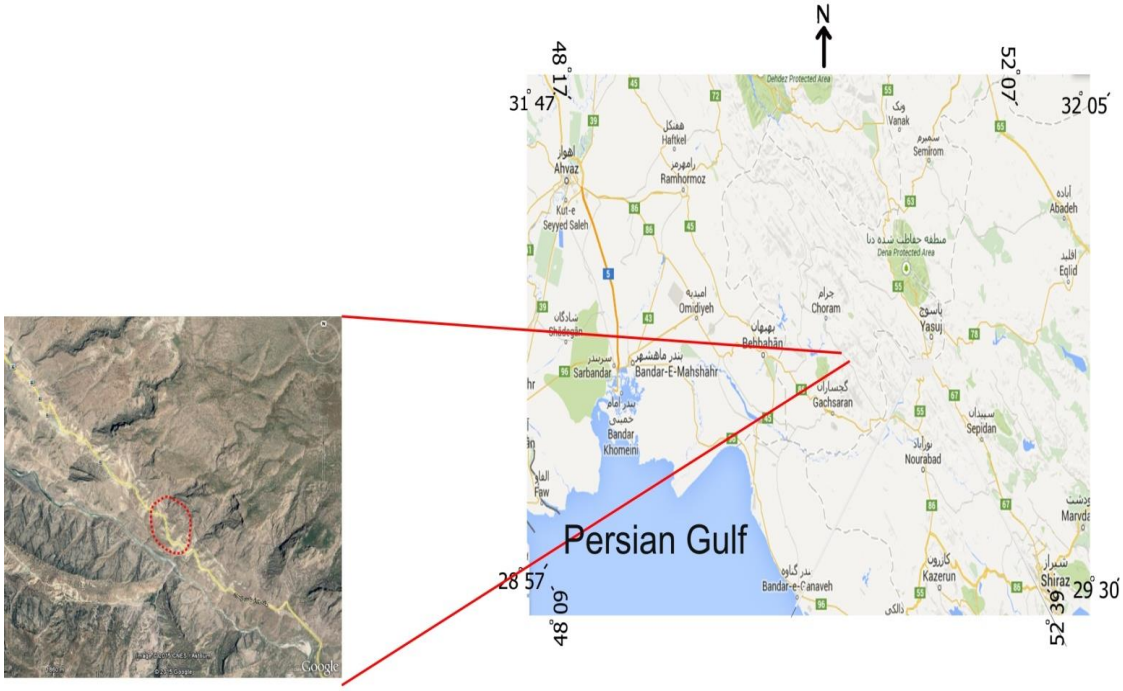

Figure 1: Map of the southwest Iran region showing the location of the Lar anticline section. The satellite map showing to define the coordinate point in base of sampling (N 30° 36′ 58″, E 50° 50′ 40″)

Biostratigraphy

Biostratigraphy data are the important reply to define many stratigraphics queries. Biostratigraphy investigation of tertiary outcrop that included the main oil basin, mostly studied with foraminifera and calcareous nannoplantonic. In this study, 21 species define and apply to define Biozone. Dinoflagellate cysts are an important group of microfossils in petroleum exploration all over the world, due to their potential to resolve questions about age dating and correlation. The remarkable morphological diversity displayed by dinoflagellate cysts facilitates their identification. Most of them are short-lived and, geographically widespread in marine sediment's thanks to their planktonic nature. Several zonation schemes based on dinocysts have been proposed for the Eocene, but almost all of them have been established in high and middle latitudes, whereas data from tropical areas are scarce or even lacking. Zonal schemes established in the Northern Hemisphere (northwestern Europe and Canada) cannot be applied without modifications to the Middle East. This is probably due to the following reasons: Water temperature and oceanic circulation patterns seem to constitute the two principal factors in the determination of provincialism in dinoflagellate cysts (Ramirez, 1990). Today, some species of dinoflagellate cysts are confined to the tropical/subtropical regions, while others are found exclusively in high latitudes. During the middle to late Early Eocene, the oceans and seas are characterized by a rather uniform warm global climate and warm marine conditions are indicated by oxygen isotope ratios of planktonic and benthic foraminifera recovered worldwide from many locations.

Table 1: Thermal maturity index, based upon spore and pollen colors that indicate oil prone for most of the samples

Sample No	Color of spore and pollen	TAI	Maturity	Hydrocarbon
1	very dark brown	-4	Over mature	*Dry gas or barren*
2	dark brown	+3	mature	*Liquid petroleum*
3	pale brown	-3	mature	*Liquid petroleum*
4	Brown	+3	mature	*Liquid petroleum*
6	Brown	+3	mature	*Liquid petroleum*
7	pale brown	-3	mature	*Liquid petroleum*
8	pale brown	+2	mature	*Liquid petroleum*
9	pale brown	-3	mature	*Liquid petroleum*
10	Brown	+3	mature	*Liquid petroleum*
11	Brown	+3	mature	*Liquid petroleum*
12	pale brown	3	mature	*Liquid petroleum*
13	pale brown	3	mature	*Liquid petroleum*
18	pale brown	3	mature	*Liquid petroleum*
20	pale brown	3	mature	*Liquid petroleum*
24	pale brown	3	mature	*Liquid petroleum*
26	Brown	3	mature	*Liquid petroleum*
28	pale brown	2+	mature	*Liquid petroleum*
30	pale brown	+2	mature	*Liquid petroleum*
32	Brown	+3	mature	*Liquid petroleum*
35	Brown	+3	mature	*Liquid petroleum*
39	Brown	+3	mature	*Liquid petroleum*
41	Brown	+3	mature	*Liquid petroleum*
45	pale brown	3-	mature	*Liquid petroleum*
47	Brown	+3	mature	*Liquid petroleum*
51	pale brown	-3	mature	*Liquid petroleum*
52	pale brown	-3	mature	*Liquid petroleum*
55	Brown	+3	mature	*Liquid petroleum*
68	Brown	+3	mature	*Liquid petroleum*
77	Brown	+3	mature	*Liquid petroleum*
78	Brown	3	mature	*Liquid petroleum*
81	pale brown	3	mature	*Liquid petroleum*
83	Brown	+3	mature	*Liquid petroleum*
87	Brown	+3	mature	*Liquid petroleum*

Within the Middle Eocene, the climate started to deteriorate, leading to a steeper temperature gradient from lower to higher latitudes. This climatic change was perhaps more pronounced in tropical regions (e.g. Sloan & Rea, 1995) and did lead to an increase in the differences between low latitude and middle to high-latitude assemblages.

Biozone: *Palaeoperidinium pyrophorum* interval zone

Age: Late Paleocene (Thanetian)

Occurrence: from 135.2m to 154.3m

Definition: The base of *Palaeoperidinium pyrophorum* interval zone defined by FAD of *P. pyrophorum* and the top defined by LAD of *Areoligera gippingensis*.

The taxa companions whose events concord to this biozone are *Cryodnium meridianum*, *Multicellites* sp.

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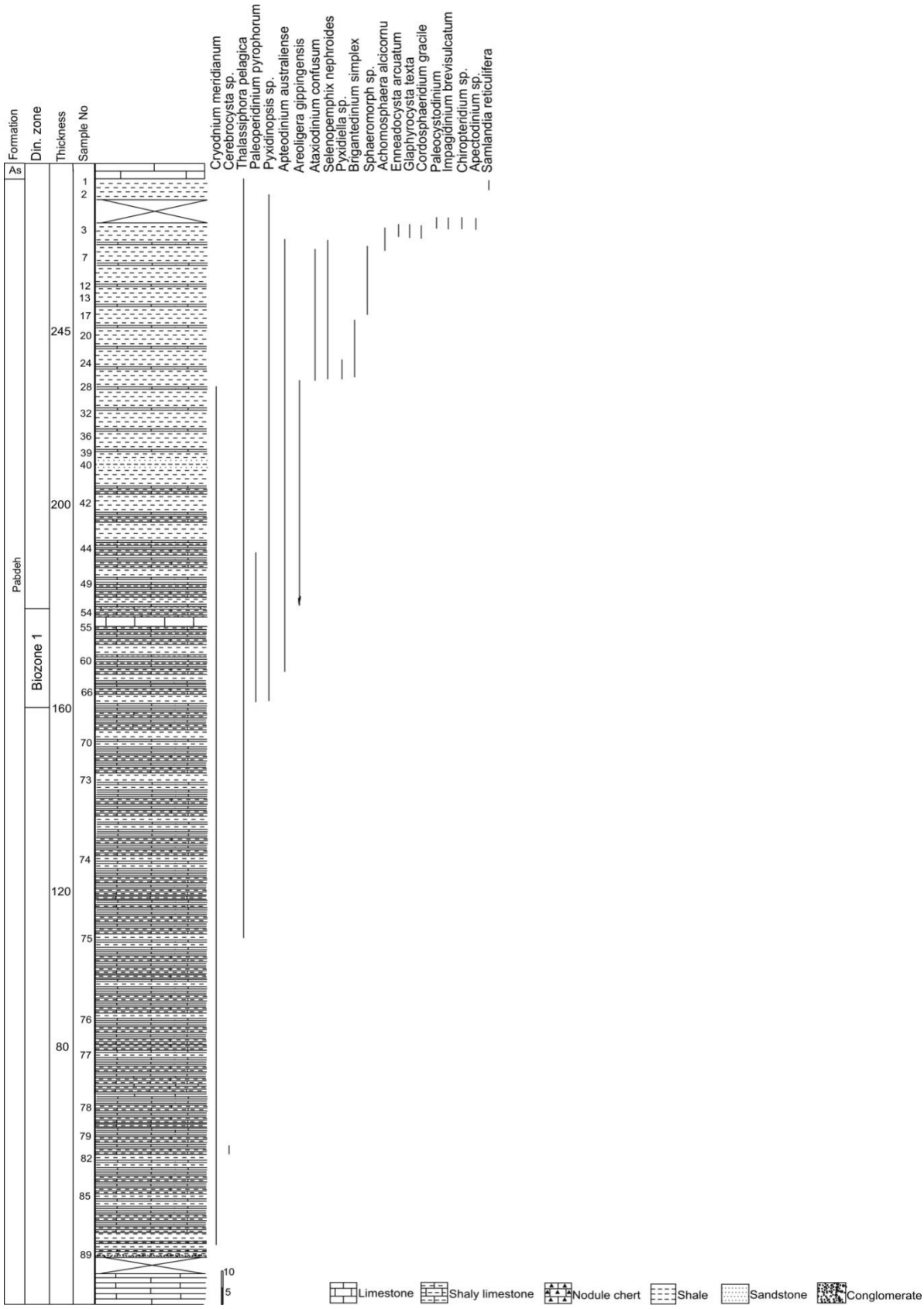

Figure 2: Stratigraphy distribution of dinoflagellate cysts in the Lar anticline section

Thermal Maturity

Pabdeh Formation is the source rock in Zagros basin and existence of abundant palynological element in this formation provided a condition to study thermal maturity about 33 samples that contain spore and pollen. These two reasons are the best indicator for defining thermal maturity founded about changing color range from pale yellow to dark brown. Thus yellow color specified the immature organic matter, and brown color range indicated petroleum prone. The most of the samples are in brown color range. Therefore, thermal maturity pointed in a liquid petroleum generation (Table 1).

RESULTS AND DISCUSSION

Result

Of the 89 samples processed from the Paleogene of Pabdeh formation. Marine and terrestrial palynomorphs are in most samples. Preservation of dinoflagellates is moderate to good in most productive samples. Eight samples were processed by the end of Formation were barren of palynomorphs. A total of 21 marine palynomorph species (mostly dinocysts) were recorded in this study and are listed in figure1 and 2. Their stratigraphics distribution in the Paleocene to early Oligocene of this section is given in figure 2. In this study according to the species and boizone late Paleocene to early Oligocene defined for this section. About thermal maturity index most of sample in liquid petroleum generation. Accordingly there are a lot of petroleum's wells exploiting oil and gas. This is concordance between thermal maturity and oil exploration.

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