PROSIDING

ISBN 978-602-5534-47-8

YOGYAKARTA
OKTOBER
2019

SEMINAR NASIONAL
TAHUN KE-5

CALL FOR PAPERS DAN PAMERAN
HASIL PENELITIAN DAN
PENGABDIAN
KEMENRISTEKDIKTI RI

SAINS & TEKNOLOGI

PENGEMBANGAN RISTEK DAN PENGABDIAN
MENUJU HILIRISASI INDUSTRI

RISTEKDIKTI

LEMBAGA PENELITIAN DAN PENGABDIAN KEPADA MASYARAKAT
UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN"
YOGYAKARTA
2019

PROSIDING

SEMINAR NASIONAL TAHUN KE-5, *CALL FOR PAPER* DAN PAMERAN HASIL PENELITIAN & PENGABDIAN MASYARAKAT KEMENRISTEKDIKTI RI

SAINS & TEKNOLOGI

PENGEMBANGAN RISTEK DAN PENGABDIAN MENUJU HILIRISASI INDUSTRI

YOGYAKARTA, 16 - 17 OKTOBER 2019

LEMBAGA PENELITIAN DAN PENGABDIAN KEPADA MASYARAKAT
UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN"
YOGYAKARTA
2019

PROSIDING
SEMINAR NASIONAL TAHUN KE-5, *CALL FOR PAPER* DAN PAMERAN HASIL PENELITIAN & PENGABDIAN MASYARAKAT KEMENRISTEKDIKTI RI

PENGEMBANGAN RISTEK DAN PENGABDIAN MENUJU HILIRISASI INDUSTRI

Cetakan Tahun 2019

Katalog DalamTerbitan (KDT):

Prosiding Seminar Nasional dan *Call For Paper*
Pengembangan Ristek dan Pengabdian menuju Hilirisasi Industri
LPPM UPNVY

1.444 hlm;21 x 29.7cm.
ISBN: 9 7 8 - 6 0 2 - 5 5 3 4 - 4 7 - 8

LPPM UPNVY PRESS

Universitas Pembangunan Nasional "Veteran" Yogyakarta
LPPM UPNVY Gd. Rektorat Lantai 4
Jl. Padjajaran 104 (Lingkar Utara), Condong Catur, Yogyakarta 55283
Telpon (0274) 486733, ext 154
Fax. (0274) 486400

www.lppm.upnyk.ac.id
Email: lppm@upnyk.ac.id

Penata Letak : Dedi Fatchurohman Hermawanto
Nanik Susanti
Desain Sampul : Sri Utami

Distributor Tunggal
LPPM UPNVY Gd Rektorat Lantai 4
Jln. Padjajaran 104 (Lingkar Utara), Condong Catur, Yogyakarta 55283
Telpon (0274) 486733, ext 154
Fax. (0274) 486400

DAFTAR REVIEWER
SEMINAR NASIONAL TAHUN KE-5, CALL FOR PAPER DAN PAMERAN HASIL PENELITIAN & PENGABDIAN MASYARAKAT
KEMENRISTEKDIKTI RI
16 - 17 OKTOBER 2019
LP2M UNIVERSITAS PEMBANGUNAN NASIONAL "VETERAN" YOGYAKARTA

1.	Prof. Dr. Ir. Sari Bahagiarti K, M.Sc.	(UPNVY)
2.	Prof. Dr. Didit Welly Udjianto, M.S.	(UPNVY)
3.	Prof. Dr. Arief Subyantoro, M.S.	(UPNVY)
4.	Prof. Dr. Danisworo, M.Sc.	(UPNVY)
5.	Prof. Dr. Bambang Prastistho, M.Sc.	(UPNVY)
6.	Ptof. Dr. Suwardjono, M.Sc.	(UGM)
7.	Prof. Dr. Jogiyanto Hartono, M.Sc.	(UGM)
8.	Prof. Dr. Sucy Kuncoro, M.Si	(UNNES)
9.	Prof. Bambang Subroto, M.M.	(Brawijaya)
10.	Prof. Ahmad Sudiro	(Brawijaya)
11.	Prof. Idayanti, M.Si.	(UNHAS)
12.	Dr. Ardhito Bhinadi, M.Si.	(UPNVY)
13.	Dr. Ir. Heru Sigit Purwanto, M.T.	(UPNVY)
14.	Dr. Sri Suryaningsum, S.E., M.Si., Ak	(UPNVY)
15.	Dr. Mahreni, M.T.	(UPNVY)
16.	Dr. Hendro Widjanarko, S.E, M.M.	(UPNVY)
17.	Dr. Joko Susanto, M.Si.	(UPNVY)
18.	Dr. Rahmat Setiawan, M.Si.	(UNAIR)
19.	Dr. Rahmad Sudarsono, M.Si.	(UNPAD)
20.	Prayudi, S.I.P., M.A., Ph.D.	(UPNVY)

DAFTAR ISI
SAINS & TEKNOLOGI

PALEOTEMPERATURE INTERPRETATION BASED ON CALCAREOUS NANNOPLANKTON OF KEDUNG SUMBER RIVER SECTION, SOKO, BOJONEGORO, EAST JAVA

Siti Umiyatun Choiriah[1], Carolus Prasetyadi[1], Rubiyanto Kapid[2],
[1]*UPN "Veteran" University/Department of Geology Engineering, Yogyakarta, Indonesia*
[2]*Bandung Institute of Technology/Department of Geology, Bandung, Indonesia*
Email: umiyatunch@yahoo.com , ruby@gl.itb.ac.id

Abstract
Analysis of 64 samples taken from the Kedung Sumber River section represent of Kalibeng Formation, Atasangin Member, Klitik Member, Sonde Formation, and Pucangan Formation. The detail of nannoplankton analysis showing that temperature changes influenced to the growth of nannoplankton. Result of this study reveals that a number of 32 zones paleotemperature change. Age of the Kalibeng Formation is Late Miocene to Early Pliocene (NN10-NN13), divided into nine zones: 1/warm, 2/cold, 3/transitional, 4/warm, 5/cold, 6/warm, 7/cold, 8/cold, 9/warm zone. Atasangin Member are divided into 3 zones: 10/cold, 11/warm, 12/cold zone. Age of this member is Early Pliocene (NN13-NN14). Klitik Member is Early Pliocene to Late Pliocene (NN14-NN17), and divided to 7 zones: 13/transitional, 14/warm, 15/cold, 16/warm, 17/cold, 18/warm zone. Age of Sonde Formation is NN18-NN20 (Late Pliocene to Early Pleistocene), have into 7 zones: 19/cold, 20/warm, 21/transitional, 22/cold, 23/transitional, 24/cold, 25/transitional, 26/ cold, 27/transitional zone, 28/warm, 29/cold zone. Pucangan Formation are divided into 3 zones: 30/warm, 31/transitional, 32/cold zone. Age of this formation is Pleistocene (NN20-NN21).
Keywords: *Palaeotemperature, nannoplankton, Kedung Sumber*

INTRODUCTION

Researches of fossil are one of the most important tools for the study of sedimentary rocks and basins. First, the succession of evolutionary appearances and extinctions provides age control, which is critical for understanding of basins evolution and validation of geological concepts. Second, fossils are useful for interpretation of local paleoenvironment, paleoclimate, and also reconstructions of paleobiogeographic (van Gorsel., et al., 2014).

The Kedung Sumber River section, located in Soko, Bojonegoro, East Java, Indonesia (Figure 1). The section consists of Kalibeng Formation, Atasangin Member, Klitik Member, Sonde Formation, and Pucangan Formation.

The study area is a part of Kendeng Zone, East Java Basin. This section of the study area was selected because this section has a sedimentation sequence consisting mostly of fine-grained marine sedimentary rocks that contain abundant microfossils with age from Early Miocene to Pleistocene.

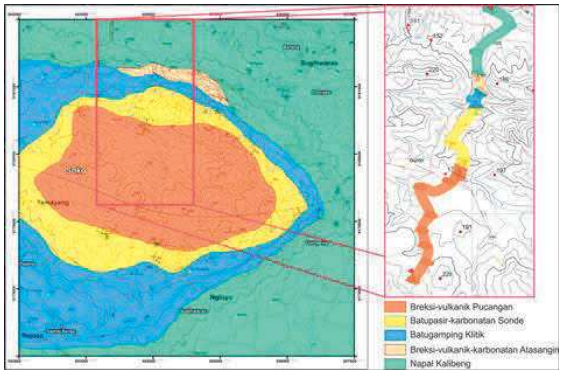

Figure 1. Geological map of the study area

Calcareous nannoplankton included of planktonic organisms, who are sensitive to environmental changes, such as fluctuations of light, salinity, temperature, sea-level change, ocean productivity, nutrients and water pollution. The role of the calcareous nannoplankton in reconstructing paleoecological changes, for identifying global and regional environmental development, and to predict of climatic change.

The calcareous nannoplankton, included of the planktonic organisms, reflects with high fidelity environmental changes, such as fluctuations of seawater, salinity, temperature, sea-level changes, ocean productivity, nutrients and water pollution. The key role of the calcareous nannoplankton in reconstructing palaeoecological changes, in identifying global and regional environmental modifications and in advancing climatic predictions is argued (Melinte and Dobrinescu, 2004).

Paleotemperature interpretation in Kendeng Zone has been done by Choiriah (1999) using calcareous nannoplankton and Van Gorsel & Troelstra (1981) using plankton foraminifera. The results of his study showed different results. This is because it has a different lithostratigraphic

METHODS

The samples for calcareous nannoplankton studies are collected from sediment outcrops with a certain interval. Very small samples are needed. The preparation technique of smear-slides for calcareous nannoplankton analysis is simple and the cheaper. The Nannoplankton zones of Martini (1971) were applied. Specimens were randomly counted using a grid pattern.

Several parameters are used to interpret the paleotemperature for each sample, which must be calculated and ratio, i.e. the total amount:

1) Species (diversity)
2) Individual (abundance)
3) Species of Discoaster
4) Individual of Discoaster
5) *Discoaster pentaradiatus*
6) Form of Coccolith
7) Species of cold temperatures
8) Species of environmental characteristics with cold temperature
9) Species of environmental characteristics with transition temperatures
10) Species of environmental characteristics with warm temperature
11) Species that characterize the environment with warm temperatures
12) Individuals who characterize a warm temperature environment

13) Species ratio as indicator of cold environment
14) Species ratio as indicators of transition environment
15) Species ratio as indicators of warm environment

RESULT AND ANALYSIS

The lithostratigraphic nomenclature used in this study follows regional stratigraphy (Pringgoprawiro, 1983) (Figure 2).

Stratigraphy of Kedung Sumber section in this study area is composed Calcareous sandstone of Kalibeng Formation, Volcanic breccia unit of Atasangin Member, Limestone Unit of Klitik Formation, Calcareous sandstone of SOnde Formation, and Volcanic breccia Unit of Pucangan Formation (Figure 3).

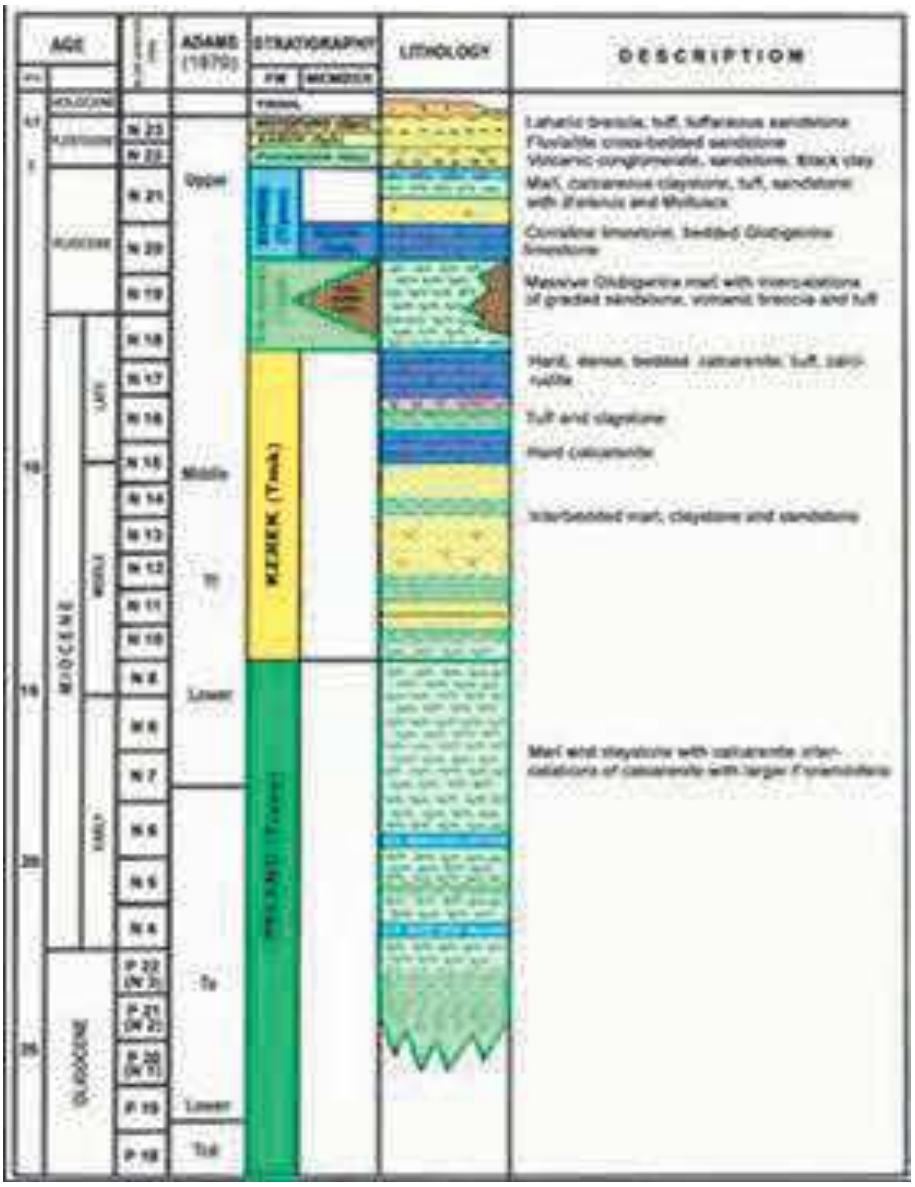

Figure 2. Regional Stratigrafi of Kendeng Zone (Pringgoprawiro, 1983)

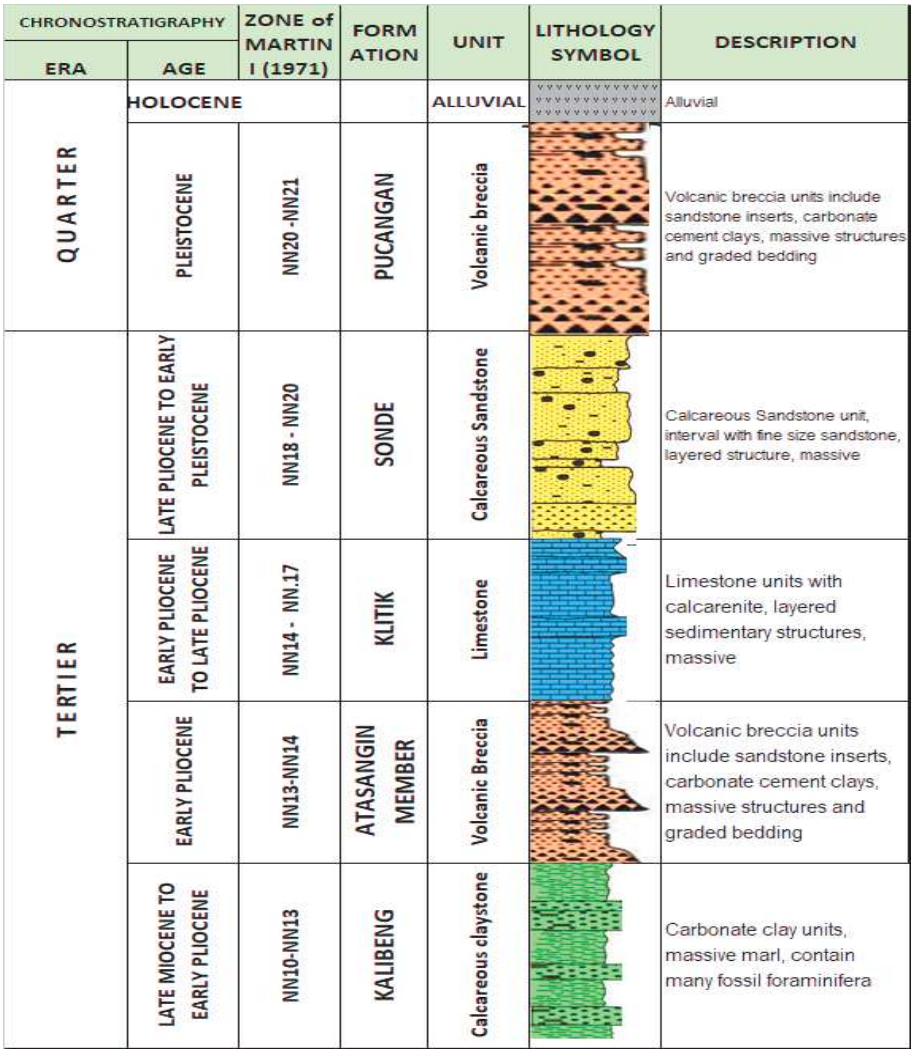

Figure 3. Stratigrafi of Kedung Sumber, Soka (Tim Research, 2016-2019)

Analysis of nannofossil found in the study area from a total of 64 samples of rock results in 11 genus and 32 species of nannofossil (Table 1)

PALEOTEMPERATURE INTERPRETATION

Interpretation of paleotemperature based on calcareous nannoplankton analysis divided into several parameters, such as: (Figure 4)

1. Total of diversity, shows 21 zones of paleotemperature change zone, that is 8 cold zones, 8 transitional zones, and 5 warm zones.
2. Total of abundance indicated that 16 paleotemperature zones, that is 7 cold zones, 7 transitional zones, and 2 warm zones.
3. Amounts of species *discoaster*, shows there are 23 paleotemperature zones. This zone indicated 8 cold zones, 6 transitional zones, and 9 warm zones.
4. Total of individual *discoaster*, there are 22 paleotemperature zones, this zone are 9 cold zones, 5 transitional zones, and 8 warm zones.
5. Amounts of *Discoaster pentaradiatus*, shows there are 10 paleotemperature zones. This zone are 5 cold zones, 2 transitional zones, and 3 warm zones.

6. Amounts of individual coccolith forms (*Calcidiscus leptoporus, Coccolithus pelagicus, Gephyrocapsa caribbeanica, Gephyrocapsa oceanica, Helicosphaera carteri, Helicosphaera kamptneri,* and *Helicosphaera sellii*), indicated of 32 paleotemperature zones: 10 cold zones, 9 transitional zones, and 13 warm zones.
7. Amounts of species cold (*Coccolithus pelagicus, Discoaster intercalaris, Discoaster tamalis, Gephyrocapsa caribbeanica, Thoracosphaera saxea*), shows there are 29 paleotemperature zones, that is 6 cold zones, 11 transitional zones, and 12 warm zones.
8. Total of individual cold, indicated of 20 zones of paleotemperature: 6 cold zones, 6 transitional zones, 8 warm zones.
9. Amounts of species transitional (*Calcidiscus leptoporus*), because there is only one species is found, on this parameter divided into 3 transitional zones.
10. Total of individual transitional, because there is only one species and one individual is found, on this parameters divided into 3 transitional zones.
11. Total of species warm: *Ceratolithus rugosus, Discoaster asymmetricus, Discoaster blackstockae, Discoaster pentaradiatus, Gephyrocapsa oceanica, Rhabdosphaera clavigera*, indicated of 33 paleotemperature zones: 15 cold zones, 14 transitional zones, and 4 warm zones.
12. Total of individual warm, indicated of 32 paleotemperature zones, that is 14 cold zones, 8 transitional zones, and 10 warm zones.
13. Cold species Ratio indicated that 29 paleotemperature zones: 8 cold zones, 9 transitional zones, and 12 warm zones.
14. Transitional species Ratio indicates the existence of 3 paleotemperature zones (2 transitional zones and 1 warm zone).
15. Warm species Ratio indicated of 33 paleotemperature zones, that is 14 cold zones, 10 transitional zones, and 9 warm zones.

Characteristics of each parameter is interpreted paleotemperature changes with a different color (Figure 4). The color differences are green is cold zone, the temperature is <11^{o}C, red color is transitional zone, the range of temperature is (11^{o}C-18^{o}C), and the yellow color is warm zone, and range of temperature is (19^{o}C-30^{o}C).

CONCLUSION

Each parameter of temperature change shows different interpretations of temperature changes. The results of all parameters are interpreted 32 temperature zones consisted of 13 cold zones, 8 transition zones, and 11 warm zones.

Kalibeng Formation is Late Miocene to Early Pliocene (NN10-NN13), composed of 9 zones. The zones are: 1/warm, 2/cold, 3/transitional, 4/warm, 5/cold, 6/warm, 7/cold, 8/cold, 9/warm zone.

Atasangin Member is Early Pliocene (NN13-NN14) and composed of 3 zones: 10/cold, 11/warm, 12/cold zone. Age of Atasangin Member

Klitik Member is Early Pliocene to Late Pliocene (NN14-NN17), and divided to 7 zones. These zones are: 13/transitional, 14/warm, 15/cold, 16/warm, 17/cold, 18/warm zone.

Age of Sonde Formation is NN18-NN20 (Late Pliocene to Early Pleistocene), and consists of seven zones. These zones are: 19/cold, 20/warm, 21/transitional, 22/cold, 23/transitional, 24/cold, 25/transitional, 26/ cold, 27/transitional zone, 28/warm, 29/cold zone.

Pucangan Formation composed of 3 zones: 30/warm, 31/transitional, 32/cold zone. Age of thid formation is Pleistocene (NN20-NN21).

ACKNOWLEDGEMENT

We would like to thank LPPM UPN "Veteran" Yogyakarta, Indonesia (for research foundation), PUPT Kendeng Team for helping in the field work, also thanks to Vian and Wawan that helped collect field data and the fossil analysis. Our thanks also go to Chair of Geological Engineering Department, FTM, UPN "Veteran" Yogyakarta for the support to our research.

REFERENCES

Bemmelen, van, R.W., 1949 *: The Geology of Indonesia*, IA, Government Printing Office, Martinus Nijhoff, The Hague, 792 p.

Choiriah, U., 2001, The Pliocene/Pleistocene Boundary, Based on Calcareous Nannofossils, and Related Paleoclimatic Implications, Solo River Section, Ngawi Region, East Java, Indonesia, *Journal of Nannoplankton Research,* 23,1.

Choiriah, U., 1999, Penafsiran paleotemperatur berdasarkan nannoplankton pada endapan Miosen Akhir-Plistosen Lintasan Sungai Bengawan Solo, Ngawi, Jawa Timur, *Thesis*, Program Pasca Sarjana Teknik Geologi ITB.

Driever, B.W.M., 1984, The terminal record of discoaster in the Mediterranian and in the Atlantic DSDP site 397, and the Pliocene-Pleistocene boundary, *Paleontology*, *Proceedings* B.87 91), h.77-89.

Genevraye, P. de dan L.Samuel, 1972, Geology of the Kendeng zone (Central & east Java): *Bulletin*, IPA convention. Jakarta, h.17-28.

Horigome1 M.T.,P. Ziveri1, M. Grelaud, K.-H. Baumann , G. Marino1, and P. G. Mortyn, 2014, Environmental controls on the Emiliania huxleyi calcite mass, *Biogeosciences*, 11, p.2295. doi:10.5194/bg-11-2295-2014

Mihaela Carmen Melinte-Dobrinescu, 2004, Calcareous Nannoplankton, a Tool to Assign Environmental Changes, *Article in Geo-Eco-Marina* n.7, doi: 10.5281/zenodo.57517

Pringgoprawiro H., 1983, Biostratigrafi dan palaeogeografi cekungan Jawa Timur Utara pendekatan baru, *Disertasi* Doctor Teknik Geologi*, ITB*, 239 h.

Pringgoprawiro dan Sukido, 1992, Peta Geologi Lembar Bojonegoro, Jawa Timur Pusat Penelitian dan Pengembangan Geologi Bandung

van Gorsel J.T.(Han), Peter Lunt & Robert Morley 2014, Introduction to Cenozoic Biostratigraphy of Indonesia- South east Asia, Part 1, *Berita Sedimentologi* n. 29, Houston, Texas.

Table 1. Data from nannoplankton analysis of the study area

No	Nama Spesies		8	9	10	11	20	21	22	23	24	25	26	27	28	29	30	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
			Nomor Contoh Batuan LOKASI SOKO, BOJONEGORO																																							
			KALIBENG		ANGGOTA ATAS ANGIN																KLITIK						SONDE FM.KLITIK												PUCANGAN			
		NN	12	13	14																15	16			17	18	19										20		21			
1	*Calcidiscus leptoporus*	w			R																					R	R					R										
2	*Ceratolithus rugosus*	w	R																R												R											
3	*Coccolithus pelagicus*	w	F	R													R					F	F	F	F		F				R											
4	*Discoaster attus*	w							R								F			F	F		F	R																		
5	*Discoaster asymmetricus*	w		>	F																		F		R				F			R										
6	*Discoaster berggrenii* B	w			R																																					
7	*Discoaster blackstockae*	w			R																																					
8	*Discoaster brouweri*	w	F	F	F												R				R		R	R		R<																
9	*Discoaster intercalaris*	w		R																																						
10	*Discoaster mendomobensis*	w																																								
11	*Discoaster neorectus*	w	F																																							
12	*Discoaster pentaradiatus*	w		R													F								F<																	
13	*Discoaster quinqeramus*	w																							R				R													
14	*Discoaster tamalis*	w																													R											
15	*Gephyrocapsa caribbeanica*	w																																	>	R				C	F	
16	*Gephyrocapsa oceanica*	w																																		*				R		
17	*Helicosphaera carteri*	w	F	R	F																								F	F									F			
18	*Helicosphaera kamptneri*	w	F																																				R			
19	*Helicosphaera sellii*	w			F											F	R				R	R	F				R	R	F		R			R				R	R		F	
20	*Pseudoemiliania lacunosa*	w																		>	F	F			R			R	R		F	F		R				R<				
21	*Reticulofenestra haqii*	w		F	F											F	F																									
22	*Reticulofenestra minuta*	w	A	A	A			C	A								A									A	A	A		F		C		C							C	
23	*Reticulofenestra minutula*	w	A	A	A			C	A		F			C		C	A		F	A	A	A	A	A	C	A	A	A	C	C	C	C		C		C	C	C	C	C	C	F
24	*Reticulofenestra pseudoumbilicus*	w	F	C	F											F				C						R			C	R	F			R							C	
25	*Rhabdosphaera clavigera*	w			R		R	R							R					R	R					R						R										
26	*Scyphosphaera globulata*	w			R																																					
27	*Sphenolithus abies*	w	A	A	A									C		C					A	C		F		C		A			C				F	F	C	F		C	C	
28	*Sphenolithus moriformis*	w																																								
29	*Sphenolithus neoabies*	w	A	A	A				C							C	F	F	F	C	A	C	C	F	C	C		A	C		C	C	F	C	F	C	F	C	C	F	C	
30	*Thoracosphaera albatrosiana*	w			R															R			R																			
31	*Thoracosphaera heimii*	w			R																																					
32	*Thoracosphaera saxea*	w			R															R	R	R		R	R				R													

■ : **Index of Nannofosil**
VA = Very Abundant (over 10 specimens per fiel
A = Abundant (1-10 specimens per field of view).
C = Common (one specimen per 2 to 10 fields of
F = Few (one specimen per 11 to 100 fields of vie
R= rare (1 to 2 specimens per slide)

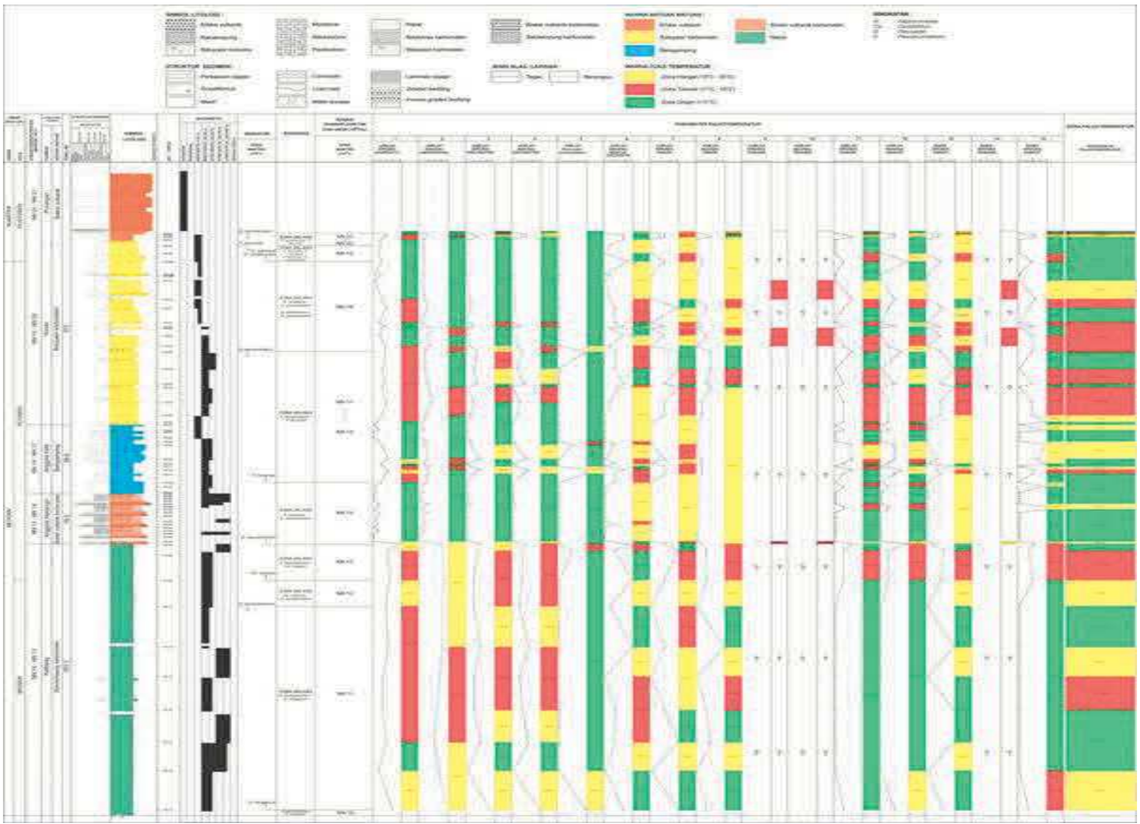

Figure 4. Paleotemperature Interpretation of Kedung Sumber, Soko, Bojonegoro