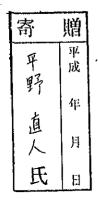


Kinematics of Cretaceous to Tertiary Pacific Plate: Discussion from Ar-Ar Age and Geochemistry of Within-Plate Basalts

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ABSTRACT

Most seamounts, islands and atolls on the present Pacific Plate were formed by submarine intra-plate volcanism mainly during the Cretaceous. Such seamounts in the West Pacific Seamount Province (WPSP) indicated that some Cretaceous seamount chains are significant for hotspot trails.

In this thesis, volcanic rock samples from the Japan Trench oceanward slope, Mizunagidori Seamount in the Joban Seamount Chain, Uyeda Ridge in the Marcus Seamount Chain and Unnamed Seamount in the Magellan Seamount Chain at the Mariana Trench, were analyzed for geochemical and mineralogical compositions and Ar-Ar dating.

Alkaline pillow basalts collected from the toe of the oceanward slope of the northern Japan Trench are with a large Fo-value of olivine xenocrysts and clinopyroxene compositions suggesting a small degree of partial melting in the upper mantle. Reconstructing Pacific Plate motion based on the data of 5.95±0.31 Ma 40 Ar- 39 Ar age indicates that the eruption occurred off the outerswell, or forebulge of the Japan Trench in the NW Pacific and the chemistry and age, further suggest that they erupted using conduits related to fracturing or faulting of the slab just before bending prior to subduction.

In the well defined NE-SW collinear Joban Seamount Chain, disturbed age progression was identified by mid-Cretaceous Daiichi-Kashima Seamount and Late Cretaceous Mizunagidori Seamount, and this chain did not show a simple chain of hotspot origin. On the other hand, the Uyeda Ridge was known also of no hotspot origin, because the basalt samples from the Uyeda Ridge are significantly younger than the

Marcus Seamount Chain and its curious bathymetry of W-E long and narrow topography is different from normal seamount of concentric shape.

Data from the seamount in the Joban Seamount Chain, Uyeda Ridge and Japan Trench oceanward slope did not admit to utilize for the Cretaceous Pacific Plate kinematics from age progressions based on hotspot trails.

Two alkaline volcanic rock samples, one peralkaline rhyolite pillow lava and another alkali olivine basalt pillow breccia, were collected from an unnamed seamount on the oceanward slope of the Mariana Trench, and the Early Cretaceous hotspot trail was defined in the Magellan Seamount chain. The dating of the peralkaline rhyolite resulted in 127.0±5.2 Ma, which is 8-18 m.y. younger than the radiolarian age of the oldest intercalated tuffaceous radiolarian claystone, early Berriasian (approximately 140 Ma), which includes fragments of volcanic glass of Na-rich alkali-basalt (hawaiite) composition of the main shield volcanism stage. Because the peralkaline rhyolite is a very differentiated volcanic rock, and commonly erupts in the last stage of the main shield volcanic activity, it was interpreted that the activity lasted for a long period at least for 8 m.y. This long shield volcanism may be reflected by the slow spreading rate of the Pacific Plate during the Late Jurassic and Early Cretaceous. The Ealy Cretaceous absolute Pacific Plate motion extended back from this unnamed seamount may be through the Hemler Seamount and Himu Seamount among the Magellan Seamount Chain. In addition, the 40 Ar- 39 Ar age of the alkali olivine basalt is 62.0 ± 2.6 Ma, early Paleocene, that is far younger than the youngest pelagic sediment cover of the Santonian-Coniacian age (approximately 84-89 Ma). These dates suggest that the volcanism of the seamount independently occurred not only in the Late Jurassic-Early Cretaceous but also in the Paleocene as the rejuvenated volcanism by another hotspot.

The Early Cretaceous Euler pole, 140 to 120 Ma, was calculated using the Magellan Seamount Chain and the Shatsky Rise. This rotation pole is on the vertical circle against the Shatsky and Magellan Trails. In this thesis, newly accurate Euler pole from the radiometric ages was also discussed.

keyword:

Pacific Plate, seamount, hotspot, Euler pole, alkali-basalt, seamount rejuvenation, Early Cretaceous, Magellan Seamount Chain

CONTENTS

L		Introduction
	1.1	Scope of Study1
	1.2	Disturbed Age Progression of Collinear Chains8
	1.3	Tectonic History of the Pacific Plate10
		Origin of the Pacific Plate
		Hotspot Tracks of Cretaceous Intra-plate Volcanism
		Absolute Motion of the Pacific Plate
	1.4	Petrological Variation of Oceanic Island Lavas17
	1.5	Ar-Ar Geochronology for Submarine Rocks
	1.6	Thesis Organization21
		Chapter 2
		Chapter 3
		Chapters 4 and 5
		Chapters 6 and 7
		Bathymetriv maps of the study area and WPSP
2		Study Areas
	2-1	Sampling Site23
	2-2	Japan Trench Oceanward Slope24
	2-3	Joban Seamount Chain27
	2-4	Uyeda Ridge in Marcus-Wake Seamount Chain30
		Uyeda Ridge
		Marcus-Wake Seamount Chain
	2-5	Magellan Seamount Chain34

3]	Methods
3	-1	Sample Preparations38
3	-2	Major and Trace Element Analyses of Bulk Rocks
3	-3	Electron Microprobe Analyses39
3	-4	Ar-Ar Dating40
		The Principle of Ar-Ar Method (K-Ar System)
		Irradiation
		Corrections
		Step Wise Heating
4	I -1	Introduction47
		Joban Seamount Chain
		Uyeda Ridge
		Early Cretaceous Spreading Center?
4	1-2	Results51
		Petrography
		Bulk Geochemistry
		Mineralogy
		Ar-Ar Age
4	4-3	Discussions58

Uyeda Ridge

		Young Alkali-basalt Eruption toward Japan Trench
	5-1	Introduction61
	5-2	Results63
		Bulk Geochemistry
		Mineralogy
		Ar-Ar Age
	5-3	Discovery of Young Basalts70
6		Fukunaga Seamount in Magellan Seamount Chain
	6-1	Introduction
	6-1 6-2	Introduction
		Results75
		Results75 Petrography
		Results75 Petrography Geochemistry
	6-2	Results
	6-2	Results

7		Absolute Motion of Early Cretaceous Pacific Plate
	7-1	Plate Tectonics
	7-2	Calculating Euler Pole90
	7-3	Early Cretaceous Euler Pole
8		Summary100
A	.ckn	owledgement102
R	efei	ences104
A	ppe	ndix
	A	Sample Location116
	В	Sample Description118
	\mathbf{C}	Microprobe Data129
	D	Ar-Ar Age150 Experimental
		Flux monitors and Correction factors of the interfering isotopes
		Age Results