2004 년도

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Proceedings of the Annual Joint Conference,
Petrological Society of Korea and Mineralogical Society of Korea
May, 28, 2004, Cheongju, Korea

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□ 장 소 : 청주 충북대학교 개신문화관

□ 주 최 : 한국암석학회, 한국광물학회

□ 후 원 : 한국과학기술단체총연합회, 충북대학교

제1발표장 (발표 12분 질문 3분 총 15분) 구두발표 15편, 포스터 12편(공통)

시 간	발 표 자	제 목	좌 장
10:00-10:40	등 록		
10:40-10:55	고정선 · 윤성효 · 현경봉(부산대) · 이문원(강원대) · 길영우(기초과학지원연)	제주도 우도 tholeiite 현무암에 대한 암석학적 연구	박 계 헌
10:55-11:10	장윤득(경북대) · 이인성(서울대)	Compositional Variation in Olivine in the Skaergaard Intrusion and Its Petrologc implications	
11:10-11:25	최정헌 · 정창식 · 김정민(기초과학지원연)	루미네선스 연대측정법을 이용한 전곡현무암 연대추정: 예비결과	
11:25-11:40	황상구(안동대) · 이문원 · 우경식(강원대)	하와이 섬의 화산 규모와 용암동굴	
11:40-11:50	**Coffee Break**		
11:50-12:05	황병훈 · 이준동 · 양경희(부산대)	경상분지 남동부 백악기말-제3기초 화강암질 마그마의 형성 및 진화과정	이 종 익
12:05-12:20	황병훈 · 이준동 · 손문 · 김종선(부산대) · 옥수석(경성대)	양산단층 주변 화강암질암 내에 나타나는 파쇄변형작용의 의의	
12:20-12:35	한 국 암 석 학 회 이 사 회		
12:35-13:30	중 식		
13:30-14:30	한 국 암 석 학 회 정 기 총 회		
14:30-15:00	포 스 터 발 표 및 **Coffee Break**		
15:00-15:15	정창식 · 정연중 · 길영우 (기초과학지원연구원)	중부 옥천대의 중생대 화성활동 시기: 충주-대전지역 화강암질암의 U-Pb 스핀연대	안 건 상
15:15-15:30	좌용주(경상대)	우리나라 중생대 화강암의 계층적 구분 - 삽첩기 화강암의 예 -	
15:30-15:45	진미정 · 김종선 · 이준동 · 황병훈(부산대)	제천화강암에 나타나는 알칼리 장석 거정의 분포상 특성에 관한 연구	
15:45-16:00	윤현수 · 홍세선 · 이춘오 · 김경수 (한국지질자원연)	괴상과 미아롤리틱 구조를 이루는 화강암류의 암석학적 및 물성 연구 - 포천동부와 문경~상주일대 화강암류를 대상으로 -	
16:00-16:20	**Coffee Break**		
16:20-16:35	이미정 · 이종익 · 허순도 · 김예동 (극지연구소) · Jacques Moutte(Ecole des Mines) · Elena Balaganskaya(Kola Science Center)	Sr-Nd-Pb isotopic systematics of the Kovdor phoscorite-carbonatite complex, Kola Alkaline Province, NW Russia: Implications for plume-related mantle source characteristics	박 영 록
16:35-16:50	권성택 · 사공희(연세대)	호남 전단대의 잠재적 변위 지시자: 산청 및 가야 회장암체	
16:50-17:05	송용선 · 김동연 · 박계헌(부경대) · 정창식 (기초과학지원연구원) · 김남훈(부경대)	마천 반려암질 층상관입암	
17:05-17:20	송용선 · 박계헌 · 백인성(부경대)	마천 반려암질 층상관입암에서 산출되는 크롬-스피넬: 진주층 퇴적물중의 쇄설성 크롬-스피넬의 기원지(provenance)로서의가능성	
17:20-17:35	조문섭(서울대)	화성의 광물과 암석: "영감"과 "기회"의 탐사선이 보내온 자료 소개	
17:35-18:00	종 합 토 론		김 용 준
18:00-	간 친 회		

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Sr-Nd-Pb isotopic systematics of the Kovdor phoscorite-carbonatite complex, Kola Alkaline Province, NW Russia: Implications for plume-related manlte source characteristics

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1. Introduction

Although the carbonatites, with their relatively exotic mineralogy and the great diversity of associated alkaline rocks, were intensively studied for the past 50 years by igneous petrologists, there is no comprehensive petrogenetic model for these rocks. The origin of carbonatite magma has yet to be agreed upon, whether it is derived by direct partial melting of carbonated peridotite or by separation of an immiscible melt fraction from an alkaline silicate magma or by crystal fractionation of carbonated alkali silicate melts (Bell & Tilton, 2001, references there in). Recently accumulated Nd, Sr and Pb isotopic data (e.g., Kwon *et al.*, 1989; Tilton & Bell, 1994; Bell, 1998) and noble gas data (Marty *et al.*, 1998) clearly point to their mantle origin, but whether the generating site of the melts parental to carbonatites is in the lithosphere or the asthenosphere is open to debate.

The Kola Alkaline Province (KAP), located in the north eastern Baltic Shield, is one of the few regions in the world where Paleozoic alkaline-ultramafic or alkaline magmatism is well developed. More than 20 massifs of Devonian alkaline-ultramafic and alkaline rocks occur in the KAP, and sixteen of which contain carbonatites. Nd and Sr isotopic studies on many alkaline-carbonatite complexes in the KAP were carried out to determine the possible mantle components responsible for the formation of them. Based on these results, Kramm (1993) suggested the Devonian 'Kola Carbonatite Line' (KCL) which consists of two end members; one lies within the enriched quadrant, similar to an EM1 component, and the other, in the depleted quadrant, similar to a DM component. However, the lower-mantle ^{3}He isotopic signature detected in several of the Devonian alkaline massifs from Kola (Marty *et al.*, 1998) suggests an involvement of other primitive mantle component in the evolution of the KAP.

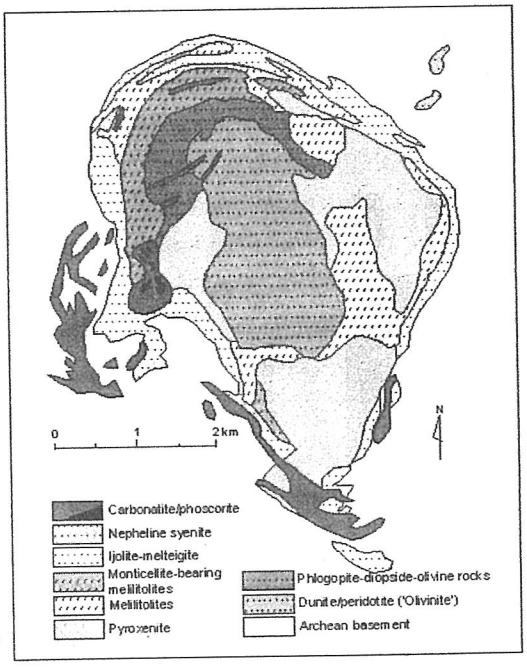

Fig. 1. Geological map of the Kovdor massif in the Kola Alkaline Province.

In this paper we present new Pb isotopic data for the phoscorites and carbonatites in Kovdor

massif. we will characterize the isotopic features of the ultramfic-alkaline rocks and carbonatites of the KAP and their mantle source regions, based on our new Pb-Nd-Sr isotope data and previously determined Nd-Sr data sets. Moreover, we will discuss a possibility of the involvement of a deep mantle plume component rather than the DM component.

2. Geological Setting

The Kovdor massif (Fig. 1) is a complex, multiphase, concentric intrusion, and consists of a great variety of rock types. The main rock types, from the oldest to the youngest, are (1) dunite (olivinite) and peridotite, (2) pyroxenite, (3) melilitolite and turjaite, (4) ijolite-melteigite, (5) phoscorite-carbonatite complex and (6) nepheline syenite. Ultramafic rocks (dunite, peridotite and pyroxenite) constitute central core of the massif. Melilite-rich rocks (turjaite and melilitolite) form irregular bodies around ultramafic core. Melilite-bearing melteigite could belong to the melilitolite series and not to the ijolite-melteigite series (Verhulst *et al.*, 2000). The alkaline silicate rocks of ijolite-melteigite series consist of outer rim of the massif.

A phoscorite-carbonatite complex, which is the main sampling site of this study, occurs as a plug in the southwestern part, and a few isolated carbonatite bodies cut the Precambrian gneisses and alkaline silicate rocks in the western and the southern parts. Numerous carbonatite dikes are observed over the whole of the massif. Nepheline syenites in association with ijolite-melteigite porphyries are found as small satellite bodies about 1 km away from the massif. A U-Pb age of baddeleyite from carbonatite of the Kovdor massif is 380 ± 4 Ma (Bayanova *et al.*, 1997), and corresponds to the range of 380-360 Ma for the other intrusions of the KAP (Kramm *et al.*, 1993).

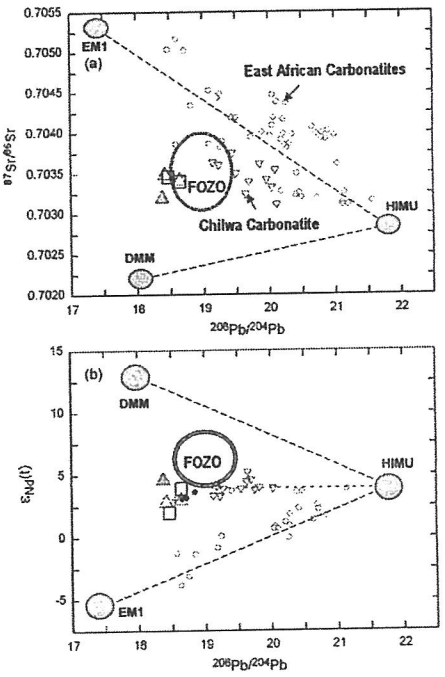

Fig. 2. (a) $^{87}Sr/^{86}Sr$ vs $^{208}Pb/^{204}Pb$ and (b) eNd(t) vs $^{206}Pb/^{204}Pb$ isotope correlation diagrams of the representative rocks in Kovdor complex. DMM, HIMU and EMI are approximations of mantle end-members taken from Hart et al. (1992). Values for FOZO ('Focal Zone') taken from Hauri et al. (1994). Other data sources: East African carbonatites (Bell and Tilton, 2001).

3. Conclusions

Sr-Nd-Pb isotopic compositions from the Kovdor complex (380 Ma) in the Kola Alkaline Province, NW Russia, have been determined to define the possible mantle components responsible for the formation of ultramafic-alkaline-carbonatite magmas.

Measured rocks plot in the depleted mantle quadrant of the Nd-Sr correlation diagram with negative eSt(t) (-5.4 to -12.2) and positive eNd(t) (1.0 to 4.7). Combined with the previous results, the fairly large range of isotopic compositions of Kovdor rocks is not in favor of a simple, closed system magmatic evolution; it suggests a complex evolution implying several magma batches derived either from an isotopically heterogeneous mantle source or from various mixing proportions of two mantle reservoirs. Two end members (KCL, by

Kramme, 1993) have been suggested to explain the isotopic compositions of the Kola ultramafic-alkaline rocks and carbonatites; One is the EM I component and the other is the DM component. However, our new Pb isotopic data suggest an involvement of fairly different component from the DM, which is relatively primitive isotopic component, probably derived from a lower-mantle plume. Though the Pb isotope data are still very insufficient in the Kola Alkaline Province, the present data from the Kovdor complex suggest that one end-member of isotopically primitive component should be similar to that of 'FOZO' component, derived from the lower mantle reservoir, the so-called '5th component' in mantle plumes. Thus we propose that a Devonian equivalent of 'FOZO' component represents one of the mantle sources responsible for the formation of the ultramafic-alkaline-carbonatite complexes in the Kola Alkaline Province.

4. References

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