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科学研究費助成事業　　研究成果報告書

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研究課題名（和文）低粘性の玄武岩質マグマの爆発的噴火メカニズムの解明

研究課題名（英文）A mechanism of explosive eruption of low-viscosity mafic magma

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研究成果の概要（和文）：本研究課題では，熱力学シミュレーションおよび天然火山噴出物の観察・分析によって，苦鉄質マグマの噴火ダイナミクスに強い影響を及ぼすマイクロライトの減圧結晶作用が，マグマの温度によって主にコントロールされることを明らかにした．また，室内でのマグマの結晶作用実験によって，結晶作用のカイネティックな遅れが残液メルトの組成変化経路の実効的冷却速度依存変化をもたらすが，メルト-斜長石間の元素分配関係そのものは実効的冷却速度に依存しないことを示した．したがって，含水・流動条件下で結晶作用が促進され，カイネティックな遅れが無視できる場合，平衡条件下で定式化されたメルト-斜長石温度計を適用可能と考えられる．

研究成果の学術的意義や社会的意義
本研究では，苦鉄質マグマの噴火ダイナミクスの多様性の原因とされるマイクロライト減圧結晶作用が，マグマの温度によって本質的にコントロールされることを明らかにした．この成果は，苦鉄質マグマの噴火ダイナミクスを理論モデル化するうえで温度が極めて本質的な要素であることを示唆する．また，マグマ温度の本質的重要性を明らかにしたことから，今後，火山噴出物の物質科学的研究を進めるうえでの指針を示したと言える．加えて，火山防災的な観点では，初期に噴出したマグマの温度を調べることで，同じ条件のマグマが噴出した時におこる現象を推測できる可能性を示した．

研究成果の概要（英文）：We performed thermodynamic simulation of degassing-driven crystallization of mafic melts. The results suggest that the behaviors of crystallization are primarily controlled by the temperature of melt and the temperature-dependent change of crystallization behavior is responsible for the variation of eruption style of mafic magmas. In addition, we analyzed run samples of cooling-driven crystallization experiments of a high-Al basaltic melt from Hawaii. The results suggest that kinetic delay of crystallization induces the change of liquid line of descent and overestimation of melt-plagioclase geothermometers against quenched temperatures whereas melt-plagioclase partition coefficient of anorthite component does not depend on substantial cooling rate. Therefore, plagioclase-melt thermmeters can be applied to estimate temperature of natural mafic magmas if kinetic delay is minimum due to the effects of shear flow and/or H2O in melt.

研究分野：マグマ科学

キーワード：爆発的噴火　マイクロライト　マグマ　減圧結晶作用　レオロジー　粘性-脆性遷移　苦鉄質　斜長石

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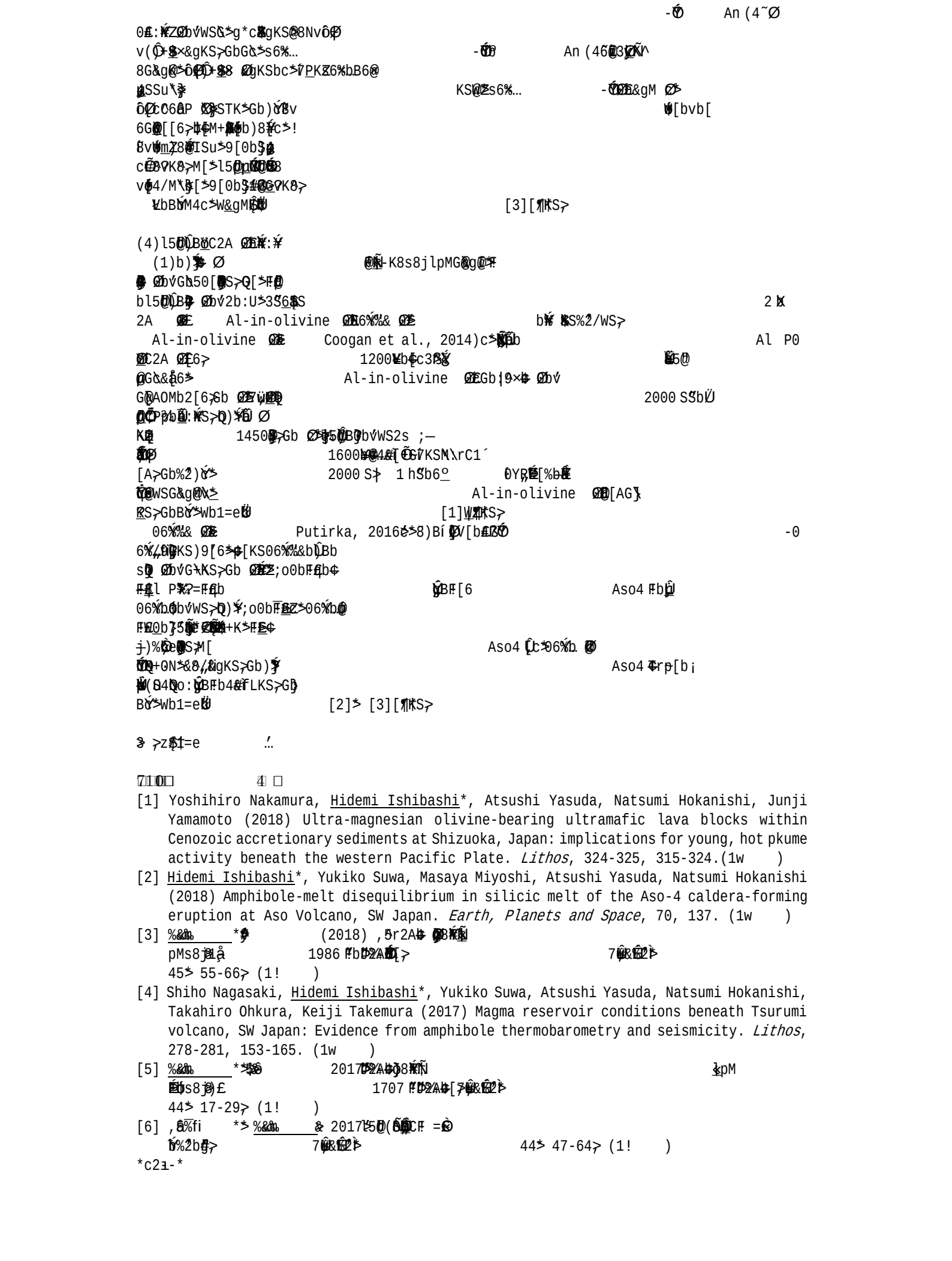

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