GEOL464 Advanced Topic in Igneous Processes – 2021 – Magma and dykes

Schedule

wk#	date	Readings*	Action	Teaching staff
1	4 March	ALLANS BEACH TRIP - Martin and White (2002) - Scott et al (2020) - Baxter thesis	Low tide 2 pm Afternoon trip (12-4 pm) Thin section preparation	MB + RC + Rachael Baxter
2	11 March	MELT GENERATION IN INTRAPLATE SETTINGS - Pilet (2015) - Scott et al (2016)	Thin section preparation	MB
3	18 March	SEM SESSION – diffusion profiles measurements on Allans Beach samples	Afternoon (12-5 pm)	MB
4	25 March	MELT MIGRATION, SEGREGATION AND ACCUMULATION - Katz et al (2006) - King et al (2011)		MB
5	1 April	MAGMA ASCENT - Brenna et al (2018) - Lensky et al (2006)		MB
Easter				
6	15 April	DYKE FOCUSING - Bruce and Huppert (1990) - Wylie et al (1999)		RC
7	22 April	EXPERIMENTAL ART FISH (1st session)	Afternoon (1-4 pm)	RC
8	29 April	EXPERIMENTAL ART FISH (2nd session)	Afternoon (1-4 pm)	RC
9	6 May	FISSURE ERUPTIONS AND HAZARDS - Witt and Walter (2017) - Neal et al (2019)		RC
10	13 May	GROUP PRESENTATIONS AND DISCUSSION – presentations on the experimental results.	30% ppt presentation	RC + MB
11	20 May	TIMING OF MAGMATIC PROCESSES – calculations of diffusion on Allans Beach samples - Costa et al (2020) - revisit Brenna et al (2018)	Bring laptops	MB
12	27 May	DYKES IN CRYSTALLINE BASEMENT – virtual fieldtrip - Brenna and Gee (2014) - Dering et al (2019)		MB
13	3 June	Summation, conclusion, exam preparation		MB

* Students in two groups will be assigned one of the selected reading to give a brief presentation each week. All students will be expected to participate to the ensuing discussion of the topic. Hence, all students are expected to read all papers and annotate and questions.

Workload Guidelines and Assessment

This is a 10-point paper. *"Each paper has a points value where one point generally represents 10 hours of work for an average student wishing to achieve an average grade".* This implies 8-10 hrs/session on average. (https://www.otago.ac.nz/study/planning/workload.html)

For best results, reading should be done before the associated session – this supports discussion. Expect to read more widely than only the assigned readings. For your presentations, exam answers, etc., the specifically assigned readings are the framework, not all of the useful information you'd like to have.

Assessments are a single Powerpoint™ presentation on 13th May (30%) and a final exam, to be scheduled in the exam period (70%).

Presentations will be conducted in the same groups that performed the experiments. Each student will be expected to deliver a portion of the presentation (e.g. background, experimental results, interpretations). Presentations should be approx. 20 minutes and will be followed by discussion where each student will be expected to participate.

For the exam you will answer two long-answer, essay-style, questions, chosen from 3 questions, in two categories broadly aligned with material lead-delivered by Marco, and material lead-delivered by Rosie. It will be a 3-hr exam.

Teaching Staff

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Assigned Readings

Brenna, M., Cronin, S.J., Smith, I.E., Tollan, P.M., Scott, J.M., Prior, D.J., Bambery, K. and Ukstins, I.A., 2018. Olivine xenocryst diffusion reveals rapid monogenetic basaltic magma ascent following complex storage at Pupuke Maar, Auckland Volcanic Field, New Zealand. Earth and Planetary Science Letters, 499, pp.13-22.

Brenna, M. and Gee, M.M., 2014. Dyke-diatreme transition in monogenetic volcanoes: insights from the Hillier Bay volcanic complex, Western Australia. Bulletin of Volcanology, 76(9), pp.1-13.

Bruce, P.M. and Huppert, H.E., 1990, Solidification and melting along dykes by the laminar flow of basaltic magma, Magma Transport and Storage, John Wiley and Sons Ltd, 87-102

Costa, F., Shea, T. and Ubide, T., 2020. Diffusion chronometry and the timescales of magmatic processes. Nature Reviews Earth & Environment, 1(4), pp.201-214.

Dering, G.M., Micklethwaite, S., Cruden, A.R., Barnes, S.J. and Fiorentini, M.L., 2019. Evidence for dyke-parallel shear during syn-intrusion fracturing. Earth and Planetary Science Letters, 507, pp.119-130.

Katz, R.F., Spiegelman, M. and Holtzman, B., 2006. The dynamics of melt and shear localization in partially molten aggregates. Nature, 442(7103), pp.676-679.

King, D.S.H., Holtzman, B.K. and Kohlstedt, D.L., 2011. An experimental investigation of the interactions between reaction-driven and stress-driven melt segregation: 1. Application to mantle melt extraction. Geochemistry, Geophysics, Geosystems, 12(12).

Lensky, N.G., Niebo, R.W., Holloway, J.R., Lyakhovsky, V. and Navon, O., 2006. Bubble nucleation as a trigger for xenolith entrapment in mantle melts. Earth and Planetary Science Letters, 245(1-2), pp.278-288.

Martin, U. and White, J.D.L., 2002. Melting and mingling of phonolitic pumice deposits with intruding dykes: an example from the Otago Peninsula, New Zealand. Journal of volcanology and geothermal research, 114(1-2), pp.129-146.

Neal, C.A. + 55 co-authors, 2019, The 2018 rift eruption and summit collapse of Kīlauea Volcano, Science, 363, 367-374

Pilet, S., 2015. Generation of low-silica alkaline lavas: Petrological constraints, models, and thermal implications. The interdisciplinary Earth: A volume in Honor of Don L. Anderson: Geological Society of America Special Paper, 514, pp.281-304.

Scott, J.M., Brenna, M., Crase, J.A., Waight, T.E., van der Meer, Q.H., Cooper, A.F., Michael Palin, J., Le Roux, P. and Münker, C., 2016. Peridotitic lithosphere metasomatized by volatile-bearing melts, and its association with intraplate alkaline HIMU-like magmatism. Journal of Petrology, 57(10), pp.2053-2078.

Scott, J.M., Pontesilli, A., Brenna, M., White, J.D., Giacalone, E., Palin, J.M. and le Roux, P.J., 2020. The Dunedin Volcanic Group and a revised model for Zealandia's alkaline intraplate volcanism. New Zealand Journal of Geology and Geophysics, 63(4), pp.510-529.

Witt, T. and Walter, T.R., 2017, Video monitoring reveals pulsating vents and propagation path of fissure eruption during the March 2011 Pu'u 'Ō'ō eruption, Kilauea volcano, 330, 43-55

Wylie, J.J., Helfrich, K.R., Dade, B., Lister, J.R., Salzig, J.F., 1999, Flow localization in fissure eruptions, Bulletin of Volcanology, 60, 432-440