

Table of contents

| | |
|--|------|
| List of figures | viii |
| List of tables | xi |
| List of Appendix..... | xii |
| 1. INTRODUCTION..... | 1 |
| 2. METHODS AND APPROACHES | 6 |
| 3. MODEL FORMULATION | 8 |
| 3.1. General framework | 8 |
| 3.2. Model assumptions and parameters determination | 10 |
| 3.3. Volcano edifice construction | 12 |
| 3.4. Constraining the magma chamber depth (H) by assessing the volcanic edifice profile..... | 14 |
| 4. APLICATIONS | 16 |
| 4.1. Principle and data analysis | 16 |
| 4.2. Lascar volcano..... | 21 |
| 4.2.1. Eruptive history and geological setting..... | 21 |
| 4.2.2. Morphological characterization..... | 21 |
| 4.2.3. Volcano edifice topography and magma chamber location (H) | 24 |
| 4.2.4. Volcano building: eruption quantity and frequency | 24 |

| | |
|--|----|
| 4.3. Lonquimay volcano | 27 |
| 4.3.1. Eruptive history and geological setting | 27 |
| 4.3.2. Morphological characterization..... | 28 |
| 4.3.3. Volcano edifice topography and magma chamber location (H) | 30 |
| 4.3.4. Volcano building: eruption quantity and frequency | 30 |
| 4.4. Llaima volcano | 32 |
| 4.4.1. Eruptive history and geological setting | 32 |
| 4.4.2. Morphological characterization..... | 32 |
| 4.4.3. Volcano edifice topography and magma chamber location (H) | 35 |
| 4.4.4. Volcano building: eruption quantity and frequency | 35 |
| 5. MAGMA CHAMBER LOCATION INFERRED FROM PETROLOGICAL TOOLS..... | 39 |
| 5.1. Analytical techniques | 39 |
| 5.2. Petrography | 41 |
| 5.2.1. Lascar volcano | 41 |
| 5.2.2. Lonquimay volcano | 41 |
| 5.2.3. Llaima volcano | 42 |
| 5.3. Thermobarometry | 44 |
| 5.3.1. Lascar volcano | 44 |
| 5.3.2. Lonquimay volcano | 44 |

| | |
|--|----|
| 5.3.3. Llaima volcano | 45 |
| 6. DISCUSSIONS | 47 |
| 6.1. Model assessment..... | 47 |
| 6.1.1. Magma storage location: comparison with petrological and geophysical technics | 47 |
| 6.1.2. Volcano dimension prediction and number of eruption required to reach it...51 | |
| 6.1.3. Summary of the effect of the magma chamber depth and size on volcano growth | 55 |
| 6.2. Comparing Lascar, Lonquimay and Llaima model results: coupling volcano morphology and plumbing systems properties..... | 58 |
| 6.2.1. Inferring the dynamic of magmas beneath Lascar, Lonquimay and Llaima volcanoes | 58 |
| 6.2.2. Volcano dimension and its geological context: A comparison of the Central (CVZ) and Southern Volcanic Zone (SVZ) | 62 |
| 6.3. Limitations of the model and challenges ahead | 67 |
| 7. CONCLUSIONS..... | 70 |
| BIBLIOGRAPHY..... | 72 |