Table of Contents

Resumen i

Abstract iii

Dedicatoria v

Agradecimientos vi

List of Tables ix

List of Figures x

1 Introduction 1
- 1.1 Statement of the problem . . . 2
- 1.2 Scope of this thesis . . . 3
- 1.3 Thesis structure . . . 3

2 Background on Lava flows and Rheology 6
- 2.1 Lava Flows . . . 6
  - 2.1.1 Rheology . . . 8
  - 2.1.2 Features and characteristics . . . 11
  - 2.1.3 Emplacement dynamics and thermal control . . . 12
- 2.2 Dimensional analysis and π theorem . . . 15

3 Material characterization and experimental setup 17
- 3.1 Material selection . . . 17
- 3.2 Manjar Nestlé characterization . . . 20
  - 3.2.1 Manjar properties . . . 20
  - 3.2.2 Manjar rheology . . . 22
  - 3.2.3 Relevant properties of lavas and analogue materials . . . 29
- 3.3 Scaled models of lava flows . . . 29
  - 3.3.1 Experimental apparatus . . . 30
  - 3.3.2 Material extrusion . . . 32
  - 3.3.3 Thermal settings . . . 32
  - 3.3.4 Data acquisition . . . 33
  - 3.3.5 Flow geometry estimates . . . 33
  - 3.3.6 Digital elevation model . . . 34

4 Results **36**
4.1 Description of flow regime and dimensions obtained 40
4.2 Trends with slope, flow rate and temperature. 50
4.3 Cooling and isothermal flows. 60
4.4 Dimensional Analysis 69
4.4.1 Flow dynamics 69
4.4.2 Flow properties and emplacement 72
4.4.3 Graetz number 76
4.5 Comparison with lava flows and experimental data 78
4.5.1 Flow dynamics 78
4.5.2 Flow properties and emplacement 79
4.6 Morphological features 83

5 Discussion **89**
5.1 Rheology 90
5.2 Variable parameters 94
5.3 Comparison with previous experiments 95
5.4 Comparison with natural flows 95

Conclusions and suggestions **98**

Bibliography **101**