CHAPTER 1

INTRODUCTION

1.1. Background

Magma evolutional change might be experienced by a volcano throughout its lifetime (Gill, 1981; Newhall, 1979). The sequence of volcanic products that erupted within periods up to several thousands of years could depict intra-crustal differentiation processes such as fractional crystallization, magma mixing, and crustal contamination. Eruptive products are often observed to evolve more through time (Martin & Rose, 1981). However, a cyclic reverse trend is possible to ensue (Gertisser & Keller, 2003). Long-term variations that occur over the entire lifetimes of a volcano or volcanic field up to tens of millions of years can depict different magma sources in the plumbing systems beneath a volcano (Di Renzo et al., 2019).

The magma plumbing system comprises the network of magma production, storage, transport channels, and chambers underlying volcanic regions (Burchardt, 2018). Numerous magma characteristics must be investigated to comprehend the magma plumbing system, including magmatic processes during evolution, magma emplacement depths, magma chamber composition, and early-formed crystals (Hasibuan, 2020). Therefore, a comprehensive data set comprising lava stratigraphy, whole-rock geochemistry, and mineral chemistry is compulsory to establish a magma plumbing system.

Magma evolution and plumbing system in calc-alkaline volcanic rocks are accounted for by periodic influxes of deep mafic magma to shallow felsic magmas in the plumbing system, e.g., Krakatau (Dahren et al., 2012), Rajabasa (Hasibuan, 2020) and Sundoro (Wibowo et al., 2022). It is suggested that the interaction of magmas emplaced at various depths contributed to the eruptive processes in those volcanoes. For instance, Rajabasa volcano of Sunda Arc shows evidence of repeated injections of mafic endmember magmas from lower to mantle depth to the upper crustal felsic endmember reservoir by multiple (Hasibuan, 2020).

Volcanoes on Java Island as part of the Sunda arc have been investigated to understand the characteristics of magma beneath the volcano. However, northwest Java volcanoes have been largely overlooked. Previous studies on northwest Java volcanoes have been conducted by (Kironi et al., 2013; Kurniawan et al., 2011, 2013). These studies are limited to the geochemical variation of the northwest Java volcanoes and the comparison to other volcanoes on Java Island. The individual magmatic evolution and plumbing system of the volcano has not yet been studied. This study investigates the magmatic evolution and plumbing system of one of the northwest Java volcanoes, Gede Salak volcano.

1.2. Aims and objective

This study aims to provide insights into Gede Salak volcano. The objectives of this study are listed as follows:

1) establish a geological map and volcanism of the Gede Salak volcano,
2) determine distinct magma types and the evolutionary trend, and

3) establish the magma plumbing system of Gede-Salak.

Geological mapping of the volcano was established by field observations and geomorphological analysis. This work presents new data on whole-rock major, minor, trace element, and mineral chemistry. The approach in this study involves discussing petrography data and whole-rock chemistry. Petrological observation focuses on mineral textures, compositional zoning patterns, and mineral assemblages. This observation helps to identify the magmatic processes the minerals have been through during the evolution of the magma system. The endmember magmas were identified via whole-rock and mineral chemistry. Then, the temperature (T) and pressure (P) conditions were estimated using geothermobarometer models. This estimation clarifies the magma storage regions beneath the Gede-Salak volcano.

1.3. Thesis structure

The thesis is comprised of a total of five chapters, including this introduction in Chapter 1. Chapter 2 presents the geological setting, previous research on the volcanoes, and the general framework of the research. Chapter 3 explains the methods and analytical techniques employed in the study. Chapter 4 presents volcanism, whole rock geochemistry, petrography, and mineral chemistry. Chapter 5 discusses magma type and the magmatic process based on whole-rock geochemistry and mineral chemistry. Additionally, Chapter 5 discusses the origin of phenocryst and magma plumbing beneath Gede Salak volcano. Chapter 6 depicts the conclusion and suggestions for further research.