

**LAVAS AND SOILS
OF THE HAWAIIAN
ISLANDS**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649625994

Lavas and Soils of the Hawaiian Islands by Walter Maxwell

Except for use in any review, the reproduction or utilisation of this work in whole or in part in any form by any electronic, mechanical or other means, now known or hereafter invented, including xerography, photocopying and recording, or in any information storage or retrieval system, is forbidden without the permission of the publisher, Trieste Publishing Pty Ltd, PO Box 1576 Collingwood, Victoria 3066 Australia.

All rights reserved.

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

This book is sold subject to the condition that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the publisher's prior consent in any form or binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

www.triestepublishing.com

WALTER MAXWELL

**LAVAS AND SOILS
OF THE HAWAIIAN
ISLANDS**

LAVAS AND SOILS
OF THE 75051
HAWAIIAN ISLANDS.

INVESTIGATIONS
OF THE
HAWAIIAN EXPERIMENT STATION
AND
LABORATORIES

BY

WALTER MAXWELL, Director and Chief Chemist

Assisted by

J. T. CRAWLEY - - - - - First Assistant Chemist,

C. F. ECKART - - - - - Second Assistant Chemist

And

E. G. CLARKE, - - - - - Field Assistant.

1. Origin and Nature of Hawaiian Soils.
 2. Availability and Loss of the Elements of Plant Food in Hawaiian Soils.
-

Published by Order of the Hawaiian Sugar Planters' Association,
1898.

027 May 19 1888

Trustees and Members of the Hawaiian Sugar Planters' Association.

Gentlemen:—I hereby submit a report, setting forth the results of investigations of Hawaiian soils.

The scope of the investigations, involving a careful study of the lavas from which the soils have been formed, may appear, at first sight, to extend beyond the requirements of the subject: An examination of the report in detail will, I believe, make it very clear that it would not have been possible to arrive at an understanding of the great differences in the nature of the soils, and in their economic values, without a preceding study of the lavas such as was undertaken.

The discussion in detail of the chemical processes, and of the laboratory methods, is required in order that other scientific men may follow the mode of the investigations, and judge of the value of the results.

In laying the plan of the investigations, and in the study and adoption of methods for its execution, I have endeavored, before all else, to observe and be guided by Nature. For this reason, repeated visits have been made to each plantation and district on the four islands: soils have been examined in place, with the lavas from which they were derived, and in careful connection with the local climatic conditions and environment.

In the efforts to establish a reliable mode of estimating the state of availability of the essential elements of plant food in the soils, I have tried to find out the processes, and the results of the processes, that operate in the field; and then to bring the methods and procedure of the laboratory into harmony with these. The results

1888

will be found to amply justify and reward the course that has been followed.

In carrying out such a plan of investigation as I have described, assistance in each part of the work was a necessity. Therefore I wish—First, to acknowledge the aid furnished by the gentlemen on plantations in obtaining soils, and in recording the climatic and other local conditions.

Further, without the co-operation of the gentlemen in the laboratory the execution of the work had not been possible. To First Assistant Crawley I have been greatly indebted, and not only for the many extremely delicate analytical results that he has furnished, but also for valuable critical observations in the adjustment of the methods of the laboratory, in order to compare with the processes in the field, upon which the laboratory procedure was based. Also, in the analysis of lavas and soils, Second Assistant Eckart has rendered indispensable assistance.

In the outdoor part of the experiments, which were conducted in the experiment station field, I have been ably and faithfully assisted, in the carrying out in detail of tests and observations by Field Assistant Clarke. In fact, it is not possible to say too much of the assistance received from these several sources.

With these and continued investigations of the soils as a basis, the experiment station is now proceeding with a broad plan, embracing the *Relations of Soils to Crops*.

WALTER MAXWELL,

Director and Chief Chemist.

Honolulu, H. I., 1898.

DEFINITIONS.

Symbol.	Name.
Si O ₂	Silica.
Ti O ₂	Titanic Acid.
P ₂ O ₅	Phosphoric Acid.
S O ₃	Sulphuric Acid.
CO ₂	Carbonic Acid.
H Cl	Hydrochloric Acid.
Cl	Chlorine.
Fe O	Ferrous Oxide.
Fe ₂ O ₃	Ferric Oxide.
Al ₂ O ₃	Alumina.
Fe ₂ Al ₂ O ₆	Iron and Alumina.
Ca O	Lime.
Mg O	Magnesia.
Mn ₃ O ₄	Manganese Oxide.
K ₂ O	Potash.
Na ₂ O	Soda.
N	Nitrogen.

ORIGIN AND NATURE

OF

HAWAIIAN SOILS.

The mineral constituents of all soils are furnished by rocks or lavas, as a result of disintegration. This truth, in the examination of particular soils, causes us, in the first place, to give precise attention to the rocks from which these soils have been derived.

HAWAIIAN LAVAS AND ROCKS.

The Islands of Hawaii are of volcanic origin, therefore the rock materials composing the mountains and elevations above the sea are igneous in character. Professor Dana says, "The Hawaiian Island group is an example of a line of great volcanic mountains. Fifteen volcanoes of the *first class* have existed, and have been in brilliant action along the line."

Petrographically, the lavas and rocks composing the great mass of the structure of these Islands are *basaltic lavas*. Recurring to the definitions of Dana, "these basaltic lavas belong to the same class, although they vary widely:—in color, from dark to light gray; in structure, from compact to highly vesicular, and from those of uniform grain to those which are prominently por-

phyritic, with chrysolite or feldspar." In his mineralogical examinations, which are confirmed by chemical analyses, Dana speaks of only one "remarkable feldspathic andesyte of a totally different rock from any other obtained from the Islands," which did not "conform to that of normal basalt."

In the following definite examinations of Hawaiian lavas, their chemical composition was taken as representing more exactly the standpoint from which, in the plan of our investigations, these lavas, as the materials furnishing soils, must be considered. In order to obtain a widely representative view of their chemical composition, typical samples of great lava masses were selected personally by the writer, in the course of repeated inspections, from districts on Hawaii, Maui, Kauai, and Oahu, and the average composition of these lavas is given in the following table, and in comparison with the analyses of American basalts, for which we are indebted to Professor Clarke, of the U. S. Geological Survey. Individual analyses of Hawaiian lavas will be given later:--

Materials.	Analyses	SiO ₂		Al ₂ O ₃		Fe ₂ O ₃		CaO		MgO		Na ₂ O		K ₂ O	
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.		
Hawaiian Lavas	18	47.90	18.23	13.36	8.99	6.05	2.20	1.50							
American Basalts . . .	20	49.15	15.66	9.50	8.29	7.90	2.84	1.90							

The chemical composition of Hawaiian lavas conforms to the normal constitution of basalts, and is in general agreement with that of basalts selected from igneous rock masses found in widely separated regions in America.