PRINCIPLES OF CHEMICAL GEOLOGY: A REVIEW OF THE APPLICATION OF THE EQUILIBRIUM THEORY TO GEOLOGICAL PROBLEMS

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649679805

Principles of Chemical Geology: A Review of the Application of the Equilibrium Theory to Geological Problems by James Vincent Elsden

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

JAMES VINCENT ELSDEN

PRINCIPLES OF CHEMICAL GEOLOGY: A REVIEW OF THE APPLICATION OF THE EQUILIBRIUM THEORY TO GEOLOGICAL PROBLEMS



\$8	
€	
46	
**	章) ((章)
PRINCIPLES OF CHENICAL SCHOLOGY	.
PRINCIPLES OF CHEMICAL GEOLOGY	
es	
** *** *******************************	18
	78
	18
	1*
	18

APPLIED GEOLOGY. By J. VINCENT ELSDEN, D.Sc. (Lond.), F.G.S. Second Edition, revised. [In preparation.

"The work is very readable, well illustrated, and suited for geological students who wish to learn some of the applications of the science."—Nature.

"Dealing with geological questions from the practical side by bringing into prominence these portions of geological science which bear upon the daily routine of the practical man."—The Engineer.

"The general plan of the work indicates a useful motive in a right direction."—Natural Science.

- ROADS: their Construction and Maintenance, with Special Reference to Road Materials. By ALLAN GERENWELL, A.M.I.C.E., F.G.S., and J. V. ELSDEN, D.Sc., F.G.S. With 48 Illustrations, 5s. net.
- MINERALOGY: the Characters of Minerals, their Classification and Description. By F. H, HATCH, Ph.D. With 115 Illustrations. 28. 6d.
- GEOLOGY. An Elementary Handbook. By A. J. JUKES-BROWNE, F.G.S. With 95 Illustrations. 28. 6d.

WHITTAKER & CO., LONDON, E.C.

PRINCIPLES OF CHEMICAL GEOLOGY

A REVIEW OF THE APPLICATION OF THE EQUILIBRIUM THEORY TO GEOLOGICAL PROBLEMS

BY

JAMES VINCENT ELSDEN D.Sc. (LOND.), F.G.S.



LONDON
WHITTAKER & CO.

2, WHITE HART STREET, PATERNOSTER SQUARE, E.C.
NEW YORK: 64 & 66, FIFTH AVENUE

1910

PREFACE

The rapid progress of physical chemistry in recent years, especially in the conception of the conditions of equilibrium in solutions, has not failed to attract the attention of workers in the field of chemical geology. The importance of this branch of research is being almost daily emphasized by new developments, which promise to throw a much-needed light upon certain problems with which the geologist is confronted. At the same time, in this country, geologists have been slow to take up this line of research, possibly because a great deal of the work that has been done has been buried in the pages of foreign literature.

In the following pages 1 have endeavoured to indicate, as briefly as the subject permits, the main points of contact between recent chemical and physical researches and the various problems of geological chemistry.

To this end I have brought together a number of geological facts and problems which seem to fall under certain recognized principles of physical chemistry.

One of the main objects which I have endeavoured to keep in view has been to show that in all these problems the key to the solution lies in the determination of the conditions of equilibrium.

The subject is so large that I have been compelled to be content in many cases with a bare allusion to work of the highest importance. I have also sacrificed to brevity a good deal of explanatory detail, the object being rather to stimulate interest in this branch of geology than to provide a complete exposition of the subject.

CONTENTS

HAVTER	PAGE
I. EQUILIBRIUM BETWEEN THE CRYSTALLINE AND AMOR-	
PHOUS STATES	1
The States of Matter—Fusion Point of Minerals—The Fusion Curve.	
II. EQUILIBRIUM AS INFLUENCED BY VISCOSITY -	19
General Considerations—Determination of Viscosity—Influence of Viscosity on the Fusion Curve—Superfusion Phenomena—Inoculation—Viscosity of Magmas—Influence on Rock Structure—Porphyritic Crystals—Influence of Varying Viscosity—Glassy Structures—Viscosity and Diffusion.	
III. DIFFUSION AS A FACTOR OF EQUILIBRIUM	39
Diffusion of Gases—Diffusion of Solids—Diffusion of Liquids—Diffusion in Rock Magmas—Influence of Gravity—Phenomena of Assimilation.	
IV. SURFACE TENSION AS A FACTOR OF EQUILIBRIUM -	56
General Principles—Practical Application—Surface Tension and Crystal Growth—Supersolubility Curve— Influence of Co-solutes—Colloidal Suspension—In- fluence of Surface Tension on Chemical Action— Capillarity Phenomena—Adsorption Phenomena,	
V. VAPOUR PRESSURE AS A FACTOR OF EQUILIBRIUM -	74
Dissociation Phenomena—Hydrated Minerals—Dissociation of Hydrates—Gypsum and Anhydrite—Hydrated Iron Oxides—Zeolites—Hydrolysis—In-	
fluence of Pressure on the Dissociation of Hydrates-	53
Hydration and Dehydration in Nature,	
vii	

viii

CONTENTS

VI. I	Equilibrium C Polymerism - stances—Sul tonite—Quar Calcite and A Magnesia Py	— Monot phur— W tz and T Aragonite roxenes.	tropic follasto: ridymit	and E nite an	nantiot d Pseu	ropic ido-Wo Silicat	Sub- llas- es—	98 98
	stances—Sul tonite—Quar Calcite and A Magnesia Py EQUILIBRIUM I	phur—W tz and T Aragonite roxenes.	ollasto: ridymit	nite an e—Alu	d Pseu minium	do-Wo Silicat	llas- es—	
						us Fort	ns—	
VII. J	- Utilitary and Department of the	N SOLUT	ions	2	3.47			116
	Solubility Co of Space Mo of Two Liq Differentiation	odels to uid Pha	Igneo	us Mag	masl	Equilibr	ium	
VIII. 7	Гне Ептестіс	THEORY	Y =	*3	(*)	200	2.	136
	Fusion Curv Aqueous Soit tion to Fuse Eutectic Cor Salts and Soi Crystallization Eutectic Poin	utions— ed Salts- nposition lutions— n—The l	Applica — Meth 1 — Con Reversa	tion to ods of nparisonal al of the	Alloy Deter betwee Norm	s—App mining een Fu al Orde	lica- the used er of	
IX. T	THE THEORY O	F SOLID	Solut	IONS IN	GEOL	OGY	32	158
800.080.09	The Thermo Type I.—Mi Series, Type Crystal Serie tion of Mix- Ternary Syst Equilibrium	x-Crystal III,—Mis s, Type Crystals- ems — B	Series x-Crysta V.—Co Morph troken	s, Type al Serie andition hotropy and Re	s, Type s for t — Mix- ecurren	Mix-Cry : IV.—I he For Crystals it Serie	estal Mix- ma- s in	, (1) H
X. C	HEMICAL EQU	ILIBRIUM	IN GE	OLOGY		4		184
Ta E	General Pri Action—The Silicates—Infl of Complex Influence of of Strain.	Solubilit luence o Ions—Vi	y Prod f the elocity	uct—Io Commo of Rea	nization n Ion- ction—	n of Fu Influe Catalys	sed nce is—	5.
INDEX 7	o Authors	(E (8	4	2	216
INDEX	ro Subjects	1000	853	(2)	35	2		220