

NOTICES OF MEMOIRS.

A NEW CLASSIFICATION OF ORE-DEPOSITS. By Dr. F. H. HATCH.

**I**N his presidential address to the Institution of Mining and Metallurgy,<sup>1</sup> Dr. F. H. Hatch gave the following outline of a new classification of ore-deposits:—

Modern views on ore-genesis may be reduced to two principal lines of inquiry, the one dealing with the agent or vehicle, by which the metals have been collected, conveyed to, and deposited in the places where they are now found, and the other with the nature of the concentrates formed in the course of these processes.

Considering the latter first, ore-deposits are found to be either—

1. Igneous differentiates.
2. Cavity-fillings.
3. Metasomatic replacements.
4. Stratified or sedimentary deposits.
5. Residual deposits.

Of these, the sedimentary deposits comprise marine, lacustrine, and fluviatile accumulations, including placers.

Coming now to the agent or vehicle of ore-concentration, these are found to be—

- (a) Molten magmas.
- (b) Gases and vapours above their critical temperatures.
- (c) Deep-seated waters, whether of magmatic or of meteoric origin.
- (d) Vadose waters.
- (e) Chemical and bacterial agents in lakes and seas.
- (f) Mechanical agents, such as moving water and wind.

It is possible, by combining the facts elicited by these two lines of inquiry, to formulate a genetic scheme of classification. For example, cavity-filling may be due to igneous injection, to gases and vapours above their critical temperatures, to deep-seated waters, or to vadose waters; again, metasomatic replacement may be brought about by gases and vapours, by deep-seated waters, or by vadose waters. By arranging these two series of relationships in vertical and horizontal columns respectively, all the various types of ore-deposits are obtained at their intersections; and in this way the classification shown in the accompanying Table (pp. 224–5) is obtained.

“Considering the world-wide interest of England in the mining of precious metals throughout the world, it seems rather singular that so little attention is being given to ore-deposits by the geologists and engineers of that country. It is true that there are notable exceptions to this, but with English mining engineers working in the most remote parts of the world it seems as if their contributions to the science of ore-deposits is disproportionately small.”<sup>2</sup>

<sup>1</sup> Delivered at the annual meeting of the Institution held at Burlington House on March 26.

<sup>2</sup> Lindgren, “Tendencies in the Study of Ore-deposits”: *Econ. Geol.*, vol. ii, p. 745, 1907.

## CLASSIFICATION OF ORE-DEPOSITS.

NATURE OF DEPOSIT.	VEHICLE OR AGENT		
	(a) Molten Magmas.	(b) Gases and Vapours above their critical temperatures.	(c) Deep-seated Waters, whether of magmatic or meteoric origin.
1. IGNEOUS DIFFERENTIATES.	Certain massive iron and nickel ores associated with basic igneous intrusions (e.g. those of Sudbury in Ontario).		
2. CAVITY-FILLINGS.	Injected tin-ores (e.g. tin-pegmatites and tin-elvans on the margin of granite intrusions).	Pneumatolytic cavity - fillings (e.g. tin quartz veins).	Hydato-genetic cavity - fillings (many fissure veins).
3. METASOMATIC REPLACEMENTS.		Pneumatolytic replacements (e.g. tin-greisens and many contact-deposits).	Hydato-genetic replacements (many veins and massive deposits, also the Rand Banket).
4. STRATIFIED DEPOSITS.			Possibly some sedimentary deposits in which the cementing materials are ores of the metals.
5. RESIDUAL DEPOSITS.			

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OF ORE-DEPOSITION.		
(d) Vadose Waters.	(e) Mechanical Agents such as moving water and wind.	(f) Chemical and Bacterial Agents in seas, lakes, and swamps.
1.		
2. Superficial fracture-fillings, such as gash-veins in limestones and cavity-fillings (e.g. the hæmatite ores of Cumberland).		
3. Some lead and zinc ores in limestones. Iron-ores replacing limestones (e.g. Cleveland). Some lateritic iron and manganese deposits. Secondary enrichments of copper ores.		
4. Some lead and copper ores interstitial in sandstones and shales.	Mechanical concentrates in bedded deposits (e.g. gold and platinum placers, stream-tin, iron-sands, detrital laterites, and other metalliferous gravels and sands).	Chemical and bacterial sediments (e.g. lake- and bog-iron ores, clay-ironstone and other sedimentary siderites, bog-manganese-ore and other sedimentary manganese ores).
5. Mantle - deposits, e.g. pisolitic and nodular ores of iron (e.g. the Bilbao and Appalachian hæmatites and limonites), of manganese (psilomelane), and of aluminium (bauxite).	Eluvial gravels formed near the outcrop of veins (e.g. those of gold, cassiterite, wolfram, galena and zinc ores).	