mercial value to work upon. It may be, since electrolysis in aqueous solutions appears impracticable, that refining in non-aqueous solutions, or in easily fusible salts, would conquer the difficulty.

In the field of producing ferro-alloys of the rare metals, for use in making special steels, even the crude electric furnaces in present use have demonstrated their ability to produce these alloys at the minimum cost. Here is a field which has been practically occupied by electric-furnace methods, or by the Goldschmidt process, using electrolytically produced aluminium, and one does not need to be much of a specialist in chemistry or metallurgy to see the wide vista of commercial opportunities here opening before us.

While our largest electrometallurgical industry is that of copper refining, the largest industrial electrochemical operation is that of producing calcium carbide. Calcium carbide, a substance practically unknown to even the skilled chemist a few years ago, and now being produced by thousands of tons annually. Calcium carbide, the commercial key to the gateway first pointed out by Wöhler, when he made artificial urea.

But why only *calcium carbide?* This is only one of the numerous carbides first produced commercially by electrical methods. Silicon carbide is another which has found broad applications and formed a new industry, and it is not only possible, but most probable, that other metallic carbides may find large applications. Moissan has shown, for instance, that uranium carbide produces, with water, liquid hydrocarbons like petroleum, and the production of artificial petroleum is a scientific possibility, although not at present commercially practicable. Besides the carbides, there are other electric-furnace products—the metallic nitrides, which are awaiting further study and utilization.

One of the most vigorous and industrious electrochemists said to me once, "We are so overwhelmed by new things of possible use to science or industry that we can at most investigate only a small fraction of them. It is a virgin continent of undeveloped possibilities."

Of the possibilities of the direct preparation of metallic compounds from the metals, the transformation of metallic salts into other compounds, the fixation of the nitrogen of the air, the increased application of the simple, direct and elegant methods of electrolytic decomposition, reduction or perduction in organic chemistry, the electrification of soils and its influence on agriculture, the sterilization of water by electrically made ozone and the disinfection of sewage and their contribution to sanitary science, and the various other unmentioned possibilities of electrochemistry, time literally fails in a simple endeavor to mention, let alone to discuss them.

The great services which electrochemistry has rendered humanity, and the march of civilization in the past decades which measure its brief but phenomenal advance, are but a fraction and an earnest of what is yet to be accomplished. If in the battle of industrial competition you are summoned by the conservatives of industry to strike your colors, answer with the courage and determination of the intrepid Captain John Paul Jones, 'Surrender, sir! We have only begun to fight.'

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Distribution of Indian Tribes in the Southern Sierra and Adjacent Parts of the San Joaquin Valley, California.

The distribution of Indian tribes in California has never been completely worked out. This is due partly to the difficulty of the undertaking but mainly to the inadequate amount of field work thus far

done in the state. The principal contribution to the subject is Stephen Powers's 'Tribes of California,' published in 1877. Powers's field work was done in the summers of 1871 and 1872, supplemented by a collecting trip in 1875 or 1876. The time at his disposal was limited, and most of it was given to the Indians of the northern half of the state, those of the southern half receiving very little attention. In discussing the distribution and relations of the southern tribes he was several times led into error, and in certain instances even referred to one stock tribes belonging to another. These errors were copied by Powell in his 'Indian Linguistic Families,' 1901.

Powers's work contains a large map showing the distribution of linguistic stocks in California, though it does not give quite all that are mentioned in the text. In the matter of nomenclature it obviously was worked over by Powell.

In 1891 appeared the Powell-Henshaw map of the linguistic stocks of North America, the California part of which is only slightly modified from Powers's map of 1877, the principal changes being in the names used for the stocks. In 1903 Dixon and Kroeber published a small map of the linguistic families of California, which, though not so credited, is copied from the Powers and Powell-Henshaw maps, with slight alterations on the northwest coast and a few changes in nomenclature. All of these maps are so generalized, particularly in the southern half of the state, that they fail to show the real boundaries of the areas and make no attempt to indicate the localities at which Indians actually live. They are misleading in that the areas allotted to the various stocks cover the entire area of the state, leaving no spaces between and no parts unoccupied. It is true that in many cases tribes were so numerous as to press closely upon one another, with definite boundaries between; but in other cases they were widely separated and there were large tracts wholly unoccupied.

The distribution of Indians conforms closely with that of the faunal and floral areas. Zoologists and botanists have found that animals and plants are arranged in definite belts the boundaries of which are determined by climatic conditions. In the northern hemisphere north of the tropics the northern zones are called Boreal, the southern Austral. In North America the Austral zones are called Lower Sonoran, Upper Sonoran and Transition; the Boreal zones, Canadian, Hudsonian and Alpine. In California no Indians live in the Boreal zones, and few if any in the upper half of the Transition zone, though certain tribes claim parts of these as summer hunting grounds. The great majority live in a single life zone—the Upper Sonoran; many in the Lower Sonoran, and a few in the Transition. The Lower Sonoran comprises the hot San Joaquin-Sacramento plain and certain outlying valleys, the Colorado and Mojave deserts, and small areas in the southern part of the state; the Upper Sonoran comprises the foothill or Digger pine belt of the Sierra, most of the coast ranges and valleys, most of the desert region of eastern California north of Owens Lake, and the greater part of southern California west of the desert; the Transition comprises the yellow of Ponderosa pine belt of the Sierra, the corresponding belt of other mountains, and a narrow strip along the humid coast.

For several years I have been engaged in mapping, for the U. S. Biological Survey, the distribution of plants and animals in California. This work takes me into all parts of the state so that I frequently come across camps of Indians belonging to different tribes. These tribes are so little known, and are disappearing so

rapidly, that I have felt it a duty to stop, whenever practicable, long enough to secure short vocabularies and find out who the various people are. Some are now on the verge of extinction and several are represented by only one or two living individuals. It is obvious, therefore, that whatever is to be learned from them must be learned at once.

Persons unfamiliar with this kind of work may be interested to know that the classification of tribes and stocks is based wholly on language. In most cases the numerals alone are sufficient for the purpose, but it is well not to rely on them too implicitly, for in certain cases they, as well as many other words, are strongly affected by contact with neighboring tribes. This is particularly true of remnants of tribes whose altered conditions have brought them into friendly intercourse with tribes with whom they were not formerly on terms of intimacy. Thus members of two disappearing California tribes (Ko-ko-he'-ba and Kosh-sho'-o) at first gave me numerals belonging to different linguistic families from those to which they respectively belong; but when their attention was called to the matter they promptly corrected the mistake. In another class of cases the effects of contact are so firmly incorporated into the language that the persons speaking do not realize that they are using borrowed words. Thus the Pakanepul of Kern Valley, assumed to be of Paiute origin because four of their numerals (2, 3, 5 and 6) and a few other words resemble or suggest those of the Paiutes, gave for 7 the Yokut word *num-chin*. This was not an accidental use of the word, for it was given me by three persons at different camps. Besides the numerals, it has been my practice to collect terms of relationship, names of animals and plants, and vocabularies of several hundred of what seem to be the more important words.

In the Sierra region the distribution of tribes conforms closely with certain faunal belts. The higher and colder belt, comprising the Boreal zones, is not inhabited, and only a few tribes go so high as the lower half of the Transition zone, most of them living in the Upper Sonoran or Digger-pine belt, which occupies the lower slopes and foothills. All the way from Sacramento canyon to Tehachapi, a distance of about 500 miles, fully 95 per cent. of the Sierra Indians dwell in this life zone. Most of the tribes live wholly within it and not one lives wholly above it.

The Southern Pacific Railroad crosses the Sierra Nevada between the Yuba and American Rivers in the territory of the Nis-se-non (or Nishinam), a branch of the so-called Midu (Mi-doo) stock. The Nissenon reach from Bear River on the north to the Cosumne River on the south. South of the Cosumne are the Mu-wa, called by Powell 'Moquelumnan.' The Muwa are one of the largest stocks in California. Their territory embraces the Upper Sonoran and lower half of the Transition zone of the west flank of the middle Sierra from the Cosumnes to Fresno Creek—a distance of 110 miles.

South of the Muwa, and ranging from Fresno Creek to Kern Lake and Tehachapi Basin, are tribes of two widely different linguistic families—Yo-kut and Pai-ute. These tribes are arranged in the main in parallel belts, the Yokuts occupying the lower and more westerly country, the Paiutes the higher and more easterly. But there is this important difference: The Yokut tribes are numerous, and until the confiscation of their lands by the whites their distribution was continuous, while the Paiute tribes are few and their distribution is and always was interrupted by broad intervals. Powers recognized the general facts that the Indians of this part of California belong in the main to the Yokut and

Paiute stocks; that the Yokut tribes were a peaceful people and were the earlier occupants of the region; and that the Paiute tribes were more powerful and warlike and entered at a later period. He states that bands of Paiutes, leaving their desert homes east of the mountains, had pushed through the passes of the Sierra, invaded certain valleys of the west slope, and driven out the Yokut people.

Tribes of other linguistic families inhabited the hot Tulare-Kern Basin and the region to the west and southwest, but they do not come within the scope of the present paper.

In the area south of Fresno Creek I have obtained vocabularies from eighteen tribes, of which nine are of Yokut origin and nine of supposed Paiute or Shoshonian origin.

THE YOKUT TRIBES.

The country of the Yokuts comprises the eastern part of the San Joaquin Valley and adjacent lower slopes of the Sierra from Fresno Creek southward to the Bakersfield Plain. Their villages, when the whites first visited this part of California, were numerous and prosperous, and the territory claimed by the various tribes spread continuously from one end of the area to the other. The tribes were most numerous in the Kaweah Delta region and on Kings River and the San Joaquin. Food was abundant and easily procured and the population was large. Some of the early settlers estimated that at the time of their arrival the number of Indians in the Kaweah Delta was at least five thousand. But this region early suffered the usual results of the coming of the whites—first the Spaniards and Mexicans, soon afterward the Americans. Not only were the fertile valley lands taken possession of, but the rich harvest of acorns of the valley oaks was coveted by the hog men, who in their greed were not willing even to divide the crop with the native inhabitants. At the north end of Tulare Lake two or three tribes were rounded up by the hog men and brutally herded and driven north during the winter rains to the mountains northeast of where Fresno now stands. Many fell by the way, and some who escaped were 'taken care of on their return.' This and other exploits help to explain the almost complete extermination of the Tache, Natoonata and several other tribes. But this is not the place to tell of the outrages committed by the whites on these inoffensive people. Let it suffice that events and incidents connected with the establishment and growth of Visalia on the Kaweah River, and of the towns on Kings River, led to the destruction of numerous tribes. Nevertheless, remnants of at least nine Yokut tribes still exist. These, beginning at the north, are:

1. *Chuk-chan'-cy,* inhabiting the foothill country between Fresno Creek on the north and the San Joaquin River on the south, from a little above Fresno Flat in the lower part of the Transition or Ponderosa pine belt down to the site of old Millerton near the lower edge of the Upper Sonoran or Digger pine belt.

2. *Pit-kah'-te* (or *Pit-kah'-che*), on the south side of the San Joaquin below Millerton, in the Lower Sonoran zone. Only a few left.

3. *Kosh-sho'-o* (or *Gosh'-sho-o*), on Dry Creek and Table Mountain, in the Upper Sonoran zone. Nearly extinct.

4. *Cho-e-nim'-ne,* on Kings River at mouth of Mill Creek, and the closely related *Cho-ki'-min-ah* of Squaw Valley, both in the Upper Sonoran zone. Only a few families left.

5. *Wik-tchum'-ne,* on Kaweah River near Limekiln or Lemon Cove, on the border between the Upper and Lower Sonoran zones.

6. *Tā-dum'-ne,* formerly on Kaweah

River below Visalia, in the Lower Sonoran zone. Now nearly extinct.

7. *Na-too'-na-ta* (or *Nă-toon'-ă-tă*), formerly on Kings River north of Tulare Lake, near the abandoned town of Kingston, in the Lower Sonoran zone. Nearly extinct.

8. *Tah'-che,* on Tulare Lake, in Lower Sonoran zone. Only a few left.

9. *Yow'-el-man'-ne,* formerly on Bakersfield Plain and thence to Kern Lake, in Lower Sonoran zone. Only a few left.

THE PAIUTE TRIBES.

The country of the Paiutes, as every one knows, is the desert region east of the Sierra. The tribes of Paiute origin which invaded the Sierra and established themselves on the west slope are:

1. *Nim,* on North Fork of San Joaquin and adjacent region, in the Ponderosa pine or Transition zone. Called *Pă-zo-ōds* by their relatives, the Hol'-ko-mah. Those living in San Joaquin Canyon are called by the Wuksăche *Kash-ă-woosh-ah.*

2. *Hol'-ko-mah* (or *Hol-o'-kom-mah,* or *To-win-che'-bă*), on Sycamore Creek and Big Creek, north of Kings River, in the lower edge of the Ponderosa pine belt and upper edge of the Digger pine (borderland between Upper Sonoran and Transition zones). There is some doubt as to the proper name of this tribe.

3. *Ko-ko-he'-bă,* in Burr Valley, with one village over the divide, looking into the valley of Sycamore Creek, in the upper part of the Upper Sonoran or Digger pine belt. Only a few left.

4. *Em-tim'-bitch,* in the valley of Mill Creek, some miles south of its junction with Kings River, in lower half of Transition and upper part of Upper Sonoran zones.

5. *Wuk-să'-che,* in Eshom Valley north of Kaweah River, along the border between the Upper Sonoran and Transition zones.

6. *Pa-kan'-e-pul,* in valley of South Fork of Kern River, in the Upper Sonoran zone. They also call themselves *Te-bot-e-lob'-e-lay* (meaning pine nut eaters). The Yowelmanne call them *Wah-lik-nas'-se.*

7. *New-oo'-ah,* on Paiute Mountain and neighboring region, from Kelso Creek on the north nearly to Tehachapi on the south, in Upper Sonoran zone. The name of this tribe in the languages of their neighbors, the Yowelmanne and Pakanepul, is *Kow-ā'-sah* or *Kah-wis'-sah.*

Geographically the Paiute tribes may be arranged in two groups, separated from each other by a considerable interval not inhabited by Indians of the same stock. The first or northernmost group comprises five tribes scattered among the mountain valleys from the region about the North Fork of San Joaquin River south to Eshom Valley, namely, Nim, Hol'-ko-mah, Ko-ko-he'-ba, Em-tim'-bitch and Wuk-să'-che. All of these are unquestionably of Paiute origin.

The second group lies much farther south, in the valley of South Fork of Kern, and thence southerly over Paiute Mountain to the neighborhood of Tehachapi, and comprises two tribes—the Pa-kan'-e-pul, on South Fork of Kern, and the New-oo'-ah, centering about Paiute Mountain. Their relations are not certain.

An examination of the languages of the Paiute tribes shows at once that they are by no means equally related either to one another or to the desert Indians from whom they originally came. The five northern tribes probably crossed the mountains in comparatively recent times, for their dialects differ only slightly from one another and from that of the Petonaquats or Owens Valley Paiutes. The two southern tribes, if really of Paiute origin, must have invaded the region in very ancient times, for their tongues differ so widely from one another and from the assumed parent stock that it is only by certain common roots

that their supposed affinities appear. In fact, apart from the numerals the resemblances are very slight and it may be possible that they indicate contact rather than relationship. Further study of these Indians is greatly needed. Their reference to the Paiute stock in the present paper is only provisional.

Contrasting the distribution of the Yokut tribes collectively with that of the five undoubted Paiute tribes of the same region, it appears that the Yokut inhabit the hot San Joaquin Valley (Lower Sonoran) and adjacent foothills (Upper Sonoran), while the Paiute tribes inhabit the cooler Ponderosa pine belt of the mountains (Transition zone). Excepting the Chukchancys, who have pushed a little way into the Ponderosa pines, none of the Yokut tribes reach higher than the Digger pine belt, and only three of them (Chuk-chan'-cy, Koshsho'-o and Cho-ki'-min-ah) reach high enough to come within this belt.

It would be convenient to speak of the linguistic families or stocks as 'nations'—as the Paiute nation, the Yokut nation, and so on—but such a designation would be incorrect, for the reason that nothing like political unity of the component tribes exists.

As well known to ethnologists, the names of linguistic stocks often present difficulties, and the names of tribes still greater difficulties. In cases where Indians have a stock name for themselves—as the desert Paiute and Shoshone; or a tribal name—as Wuksache, Wiktchumne, Chukchancy—there is no trouble, but in cases where they have no tribal name, and such cases are common, various complications arise.

Many tribes speak of themselves as THE PEOPLE, and in numerous instances their word for people has been adopted by ethnologists (and sometimes by themselves) in lieu of a tribal or stock name. Among the family names of this class are Midu, Muwa and Yokut; among the tribal names are Nim and New-oo'-ah, both meaning people—the first from *neum* or *nüm*, the last from *new'-ah*. In some cases a locative or place name is prefixed to the stock name to distinguish the tribe—as *Ahwanee* Muwa, *Chowchilla* Muwa, and so on. In the case of tribes having no definite name for themselves it is sometimes practicable to use the name given them by another tribe—for every tribe is sure to have a name in the language of its neighbor. Such names are often based on points of the compass, meaning *north people, south people*, and so on.

While the Yokuts have no common or stock name for themselves (Yokut being the word meaning 'people' in some, but not all, of the tribes), every tribe has a fixed and definite tribal name. In the case of the desert Paiutes the opposite condition prevails, for all the tribes use the stock name, while only a few have definite tribal names. Similarly, several of the Paiute tribes on the west slope of the Sierra appear to lack distinctive names for themselves; hence the names here given for them are provisional and tentative. The doubtful names are Nim, Holkoma, Pakanepul, and possibly also New-oo'-ah; the well-established names are Kokoheba, Emtimbitch, Wuksache. Of these, Kokoheba is a place name—the name of a village—which has come to be applied to the tribe.

C. HART MERRIAM.

SCIENTIFIC BOOKS.

THE CRYPTOGAMIC BOTANY OF THE HARRIMAN EXPEDITION.*

THE scientific results of the Harriman expedition to Alaska are beginning to be made public and the handsomely bound volume recently issued gives us the first of the three

* 'Harriman Alaska Expedition,' Volume V., 'Cryptogamic Botany.' New York, Doubleday, Page and Co. 1904. Pp. 404 and 44 plates.