

dress correspondence to the Chairman, at Cosmos Club, Washington, D. C.

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CURRENT NOTES ON PHYSIOGRAPHY.

PACIFIC OCEAN CURRENTS.

DR. CÄSAR PULS contributes an elaborate discussion, based on original records, of the surface temperatures and currents in the equatorial belt of the Pacific Ocean to the 'Archiv der Deutschen Seewarte' (Hamburg, XVIII., 1895, 1-38, with 12 monthly charts). The chief interest attaches to the equatorial counter current, which maintains its eastward course all across the ocean between the wind-driven, west-flowing equatorial currents on the north and south, the latter being much the stronger of these two. The north equatorial current, from 9° to 20° N., is strongest in March; it is not altogether supplied at its east end by the weak southward current along our west coast; it receives much water from the counter current which turns northwest at its east end, and not southeast, as ordinarily mapped. At the west end of the north equatorial current, part turns north to flow past Japan, and a lesser part south to join the counter current. The great south equatorial current, from 12° S. to 5° N., is strongest in September, and has its highest velocity along its northern margin, sometimes over 100 nautical miles in 24 hours. It is largely supplied by up-welling water along the west coast of South America, where the wind blows off-shore; the Humboldt surface current is not sufficient to feed it. Part of this great equatorial current turns south before reaching the Solomon Islands; the rest passes on north of New Guinea and turns sharply back at the 'root' of the

counter current, except from December to May, when this branch is turned back on itself by the northwest monsoon then and there prevalent, forming a short counter current south of the equator. The north counter current, extending all across the ocean, is said to be much influenced, but not produced, by the winds. Near its west end it is favored for three-quarters of the year by the southwest monsoon; and from July to October, when it is, as a whole, strongest and broadest, its east half is favored by the narrow belt of monsoon winds there and then occurring. It is narrowed and weakened in our winter, when these favoring winds are wanting, and from January to March, under the extended northeast trade, it may be stopped or locally reversed; but where and whenever these adverse winds weaken or shift, the current reappears, and sometimes with increased strength. Yet, as a whole, it is regarded as a compensation current, discharging eastward the excess of the wind-driven south equatorial current, which has no sufficient escape at its west end.

If a narrow current, 8,000 miles long, can be a compensation current, a previous note on this subject in SCIENCE (III., 1896, 921) should be somewhat modified. It may be added that according to these descriptions the Pacific counter current serves indirectly to carry water continually from the southern into the northern hemisphere, receiving a supply from the south at its west end, and discharging its flow chiefly northward at its east end; thus doing what is more directly accomplished in the Atlantic by the cross-equator extension of the south equatorial current past the Guiana coast. In the Pacific, as in the Atlantic, a compensation for this excess of surface movement into the northern hemisphere must exist beneath the surface, and with fuller data as to deep temperatures this may aid in deciding the cause of the

deep oceanic circulation. (See *SCIENCE* III., 185, 824.)

THE EAST AND WEST INDIES.

PROF. K. MARTIN, of Leyden, discusses the origin of the above-named region (*Zur Frage nach der Entstehung des ost- und westindischen Archipels*. Hettner's *Geogr. Zeitschr.*, II., 1896, 361-378). His style of treatment is elementary and somewhat incomplete, and his method does not reach far into the past. Sea cliffs cut in elevated coral reefs are described at three levels on Curaçao, where the successive steps seem to be of artificial regularity. As the cliffed reef rings around the island with small interruption, it is regarded as an uplifted atoll. Other examples are given. In the East Indies, on Saparua, east of Amboina, eleven terraces are found in elevated reefs; on Buton, southeast of Celebes, nine. The coastal plain of Dutch and British Guiana slopes gently northward; here reefs are wanting, as the shallow impure water was unfit for coral growth; but former shore lines are distinctly marked by elevated beaches, largely composed of shells, like the existing beach walls. Fourteen of these have been counted, Paramaribo being on one of them. Elevated coral reefs are again wanting on the larger East Indian islands, but their marginal plains contain plentiful marine shells of recent species; these being well preserved about Batavia. Additional facts are mentioned, but they hardly cover the wide areas considered. It is concluded that at a recent date the configuration of the shore lines was very unlike that of to-day, and that an extensive elevation has been in progress.

THE RIVER ETSCH.

PENCK gives an account of Etsch, flowing southward through the Tyrol to the Italian plain, where it is known as the Adige (*Zeitschr. Deutsch. u. Oesterr. Alpenvereins*, XXVI., 1895, 1-15). The river lies

somewhat to the east of the axis of a Tertiary trough that is included between the Adamello Mountain group on the west and the dissected Dolomite plateau on the east. Below its torrential headwaters, rock is not exposed in the aggraded valley floor. Lateral streams bring in much detritus, forming fans at their mouths and driving the main stream against the opposite valley wall. Up stream from each fan the slope is moderate, and the flood plain is sometimes swampy; but immediately down stream from the fans the descent is rapid. No cause is assigned for the clogging of the rock-cut valley. The narrow gorge through which the river emerges upon the plain is here, as commonly elsewhere, a result of morainic displacement from the preglacial valley. The valley is slightly incised beneath the general level of the plain for about a third of the way to the mouth; but on reaching the level where the ground water of the plain emerges in numerous springs (*fontanili*) the river becomes an aggrading stream and rises above its surroundings, so as to need diking. In this lower part of its course it is turned aside from the Po, whose aggrading action is more powerful, and for this reason the Adige pursues an independent course to the Adriatic.

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CURRENT NOTES ON METEOROLOGY.

CLIMATIC CONTROL OF CIVILIZATION IN AFRICA.

THE influence of climate on civilization in Africa was brought out by Scott Elliot before the Geographical Section of the British Association at Liverpool. Africa may be divided into four regions: (1) the wet jungle, characterized by great heat and continuous humidity; (2) the deserts, with no proper rainy season; (3) the acacia and dry grass region, with distinct dry and wet seasons, and (4) the temperate grass and forest region, with moderate rainfall, mod-