WATER RESOURCES IN THE ALTIPLANO REGION IN SOUTHERN PERU, THEIR ISOTOPE COMPOSITION AND ORIGIN

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Projects on water management systems supplying water to the arid Pacific coast in southern Peru, are being implemented, and resources of surface water and groundwater in the Altiplano region are being developed.

The Altiplano is a high plateau at about 4,500masl, with andesite volcanic cones and ridges rising from its surface to altitudes of more than 5,700masl. On the rolling surface, there are several shallow lakes, some of which are drained to the Pacific, some to the Titicaca basin, and some are drainless. Springs yielding as much as 3,001 s^{-1} occur at outcrops of aquifers or faults. Hot springs containing boron and other contaminants occur occasionally in some postvolcanic areas.

On some of the small streams, dams and weirs were constructed to control the discharge and divert water to channels of the supplying systems. Boreholes were drilled to extract groundwater for the same purpose from two main tertiary aquifers in the Maure and Capillune sedimentary formations to complement the surface water resources.

Precipitation along the Pacific coast is about 40mm per year and at the Altiplano, about 600mm per year. The precipitation is considered to originate in the atmospheric moisture arriving from the east from the Atlantic Ocean. Wetlands as well as dry pans occur at the surface of the Altiplano depending upon the geological structure and the hydrological circumstances. Isotope-hydrology methods have been used to correlate the composition of precipitation, surface water, and groundwater. Stable isotopes of oxygen and hydrogen, and occasionally tritium, were analysed.

The results of isotope analyses performed so far can be summarised as follows.

The stable isotopes O-18 and deuterium in the precipitation in the central Altiplano near Lima show a local meteoric line with a similar and only slightly lower slope than the world meteoric line. This phenomenon, if transmitted to the study area between Lake Titicaca and the Pacific coast, is in agreement with the general features of isotope composition of precipitation.

The majority of water samples from rivers, lakes, springs, and boreholes, with low values of O-18 and deuterium, correspond to the precipitation line, showing the direct meteoric origin of these samples.

Water samples, mainly from lakes, show isotope compositions that correspond to an evaporation line which is less inclined than the world meteoric line. This indicates that the water has been exposed to evaporation.

Low concentration of tritium in most groundwater samples shows that this groundwater has a long residence time; this, however, has to be defined more precisely.

The isotope composition shows a close relationship between precipitation, surface water, and groundwater, as well as a very strong influence of evaporation on the hydrological cycle which must be taken into account when considering the development of water resources in the Altiplano region.