



Abstract View

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On the Characteristics and Circulation of the Southwestern Atlantic Ocean

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ABSTRACT

The waters found within the southwestern Atlantic Ocean extend into it as separate layers with markedly different characteristics. Along the western boundary the deeper waters, derived from the North Atlantic, are warm, highly saline, oxygen-rich and nutrient-poor. This North Atlantic Deep Water (NADW) lies within the density range of the Circumpolar Water (CPW) from the south, which is cooler, lower in salinity, very low in oxygen and very high in nutrients. Where the NADW and CPW meet in the southwestern Atlantic, the NADW separates the CPW into two layers above and below the NADW—each less saline, richer in nutrients and lower in oxygen than the NADW.

Above the upper branch of the CPW lies the Subantarctic Intermediate Water, which is lowest in salinity of all the layers. Beneath the lower branch of the CPW lies an abyssal layer derived from the mid-depths of the Weddell Sea. It is colder, less saline, lower in nutrients and higher in oxygen than the Circumpolar Water.

These layers appear to be separated vertically by density gradients which tend to be sharper at the interface than in the layers themselves. These maxima in stability, which result from the interleaving of water masses from different sources, extend over hundreds of kilometers: apparently vertical exchange processes are not strong enough to dissipate them.

Within the Argentine Basin the circulation of all except the abyssal layer appears to be anticyclonic and so tightly

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compressed against the western boundary that equatorward flow is observed just offshore of the poleward flow at the boundary. Waters from the north (within the Brazil current near the surface and from the North Atlantic at greater depths) flow southward along the western boundary and turn eastward near 40°S, part returning around the anticyclonic gyre and part joining the Antarctic Circumpolar Current. Likewise the Circumpolar Waters, which have entered from the Pacific, flow northward along the western boundary to about 40°S and then turn eastward, both above and below the NADW. The abyssal waters are derived from the Weddell Sea. Within the Argentine Basin they flow northward along the western boundary and turn eastward south of the Rio Grande Rise, and then southward on the western flank of the Mid-Atlantic Ridge; the abyssal flow is cyclonic beneath the anticyclonic upper circulation.

top ▲



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