# Ocean Gazing: Episode 26
# The Antarctic Circumpolar Current, composed

*Lynne Talley: Scripps Institution of Oceanography*

<begin music>

**Ari**: I'm Ari Daniel Shapiro. And this is Ocean Gazing, the podcast where we dip into the briny seas. This time, we're headed pretty far south to the waters spiraling around Antarctica.

**Talley**: This is the only part of the ocean that has no land barrier all the way around. It connects the Atlantic to the Indian to the Pacific and back. It's huge.

**Ari**: Lynne Talley is a physical oceanographer at the Scripps Institution of Oceanography in San Diego. And she's puzzling out the ocean's circulation: basically how all that water gushes and surges and flushes around our planet. Stay tuned.

<cross-fade intro music and Lynne Talley's piano recital recording>

**Ari**: Let's start with last week's sonic stumper. It's the first movement of Schubert's Fantasie in C Major. And Lynne Talley is the one playing.

**Talley**: So my undergraduate degrees are in piano performance and physics from Oberlin College.

**Ari**: Really, you had a double major?

**Talley**: Yes, I was a double degree actually. That was the only place you could do two full degrees at the same time. It was kind of like Hermione in Harry Potter! [laughs]

**Ari**: Do you have any recordings of the piano you've played?

**Talley**: I have my senior recital from many decades ago.

**Ari**: Which is what we're listening to now.

**Talley**: When you do a piano performance major, it's in a conservatory. It all culminates in your final recital. And I hadn't listened to the recording of it for many, many, many years. And I listened to it and I recognized every little goof. [laughs] I was right there. But parts of it are fine. Most of it is fine. Actually, I was listening to it, going, "Wow, I used to play like that?" I don't play that way anymore. And I was practicing five to six hours a day back then. And I certainly don't do that now.

**Ari**: The main reason is that these days, Talley is a full-time oceanographer with lots of data to pore over. <fade out piano>

**Talley**: I like to take all the data and try to make the simplest, coherent picture out of it that I can see.

**Ari**: In particular, Talley is interested in water masses, which are, what, exactly?

**Talley**: Ok, a water mass. If you think of the ocean as five kilometers deep, you can divide it roughly into four layers.

**Ari**: It's like imagining the ocean as a big watery sandwich, with a surface layer on top, an intermediate layer below that, and then a deep layer below that and finally the abyssal layer on the very bottom.

**Talley**: The intermediate, deep and abyssal layers have sort of a faucet that turns on and dumps water into those layers in a very local place by a very specific process.

**Ari**: Let's focus on the faucet that creates what's called Antarctic Intermediate Water. That's the water that fills up the intermediate layer of the southern Atlantic and Pacific Oceans. That layer ranges from about 700-1200 meters underwater. It's as deep as 2-3 Empire State Buildings stacked top to bottom. Now, we'll underscore where this water moves with a bit of music, in a kind of homage to Talley's double degree. We start in Antarctica. <fade up The Bled's "Antarctica">

**Talley**: Think of Antarctica sitting there. It's this blob of land sitting at the South Pole. North of Antarctica, the winds are from the west to the east.

**Ari**: So it's kind of like a ring of wind coming from the west.

**Talley**: Right, it's a ring of wind. And it's simpler than the northern hemisphere cause there's no continents. It's just goin' around.

**Ari**: No land to get in the way.

**Talley**: There's no land to steer it off, right. And so it just goes round and round and round, and it spins up these huge storms. So every 3-5 days, you got another big storm coming through. So that's forcing this big current in the ocean that's going in the same direction, and it also goes all the way around. So that thing is circling the globe and it's connecting all the oceans together.

**Ari**: That current, it's called the Antarctic Circumpolar Current. And it takes quite the journey.

**Talley**: It's actually starting off of Argentina <fade up Astor Piazzolla's "Tanguedia III">, and you got a current that goes south a little ways, and then starts heading

east. It doesn't go due east: it slants slightly to the south. And it heads east past Africa, it's way far south of Africa, way, way past Africa, and it reaches Tasmania and New Zealand <cross-fade to Bic Runga's "Listening for the Weather">, and heads east past New Zealand. So you can think of it as a slant all the way across all these oceans – the Atlantic, Indian and Pacific – until it can get to Drake Passage south of South America at Chile <brief bit of Los Prisioneros' "Tren al sur">, shoots through Drake Passage and then it immediately turns left, very strong current, and shoots north this thousand kilometers back to Argentina <a flourish of Piazzolla> where it started from. So the whole thing is kind of spiraling down around Antarctica.

**Ari**: And as all that water rushes and spirals along, its temperature changes. Off the coast of Argentina, the Antarctic Circumpolar Current's greeted by warm tropical waters. That heats the current up to almost 60 degrees Fahrenheit.

**Talley**: For the Antarctic, that's pretty warm.

**Ari**: But as that current flows along, it gets colder. <slow "Listening for the Weather"> By the time it gets to New Zealand, it's cooled to 48 degrees, and when it hits Drake Passage, it's even cooler: 41 degrees. <slow "Tren al sur"> And cold water, it's heavier.

**Talley**: Cold water is heavier, right. Exactly. That's important. So you make it cold, it makes it denser, makes it heavier.

**Ari**: That colder, heavier water sinks and it stirs up the water of the Antarctic Circumpolar Current. It creates what's called a mixed layer. But what's key is that as the water spirals southwards, it gets colder and colder, and heavier and heavier.

But not all the water surging towards Drake Passage routes north to Argentina. It splits. A good amount actually bangs into South America and heads north up the western side of Chile, into the *Pacific* where it becomes Antarctic Intermediate Water.

**Talley**: And in that region is where it dives in and leaves the surface. <fade out music> So it leaves the surface moving north into the Pacific, and then way out to sea.

**Ari**: That's really, really helpful. I see it now. I see it. It's beautiful. I mean, it's just this, like, ribbon of current that's kind of descending down around and then spilling as it gets deeper into the Pacific.

**Talley**: We call that ventilation. This is the way the ocean is ventilated. Ventilated means breathing. So you're taking surface water and pushing it down into the interior of the ocean, which ventilates it. And that's important for biology and carbon cycles because it's taking surface water, which has lots of oxygen and whatever else got pumped in from the exchange with the atmosphere, and dragging

it down into the interior of the ocean. And it's ventilating the entire Southern hemisphere. That's what's so cool about it.

**Ari**: And beyond being cool, it's also important for making sense of how the ocean and atmosphere are interacting with one another.

**Talley**: The ocean's part of the global carbon cycle, and how the ocean might absorb excess carbon: there's a lot of interest in that for climate change issues. <fade up Mozart piano>

**Ari**: To understand the ocean, atmosphere and climate, it's kind of like Talley's keeping tabs on the planet's circulatory and respiratory systems. The pulse of our Earth. Ebbing and flowing, full of trill and sustain, crescendo and quiet.

<fade up Mozart further and sustain until it ends>

**Ari**: Here's our new sonic stumper.

<play sonic stumper; cross-fade to outro music>

**Ari**: Go online to oceangazing – all one word – dot org to send us your guesses for the sonic stumper and your questions and comments for Lynne Talley. You can also hear Talley explain that global warming won't lead to the next ice age.

**Talley**: We don't kick ourselves into an ice age through global warming. Global warming is warming.

**Ari**: Ocean Gazing is a product of COSEE and we're funded by the National Science Foundation.