Featured: Cliff Walters
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PRE-SCRIPT

In the premiere of BIOmarkers, the audio series that archives the oral history of organic geochemistry, we speak with Dr. Clifford Walters, a career industry expert currently at ExxonMobil. Cliff discusses his early days as a student, how he got into the field of organic geochemistry, and gives his advice to early career researchers about the future of the field.

SCRIPT

[opening music]

Fatima Husain: Welcome to BIOmarkers, an audio series that archives the oral history of organic geochemistry. I'm your host, Fatima Husain, and I'm here today with my series co-creators Angel Mojarro and Juliana Drozd. Angel and Juliana, for this first episode, can you introduce yourselves and tell us what you do?

Angel: Sure. Hi, everyone. I'm Angel Mojarro, and I'm a Ph.D. candidate in geology, geochemistry, and geobiology at MIT.

Juliana: And I'm Juliana Drozd, an undergraduate at MIT researching organic geochemistry, geobiology, and astrobiology in the Summons Lab with Angel and Fatima.

Fatima: Thanks, Angel and Juliana. We started BIOmarkers back in 2018 to capture and share the stories and history of the field of organic geochemistry.

Angel: Before, we'd hear Roger tell us anecdotes about his research, fieldwork, career, and about his colleagues. And at some point, we realized — these recollections and insights are what resulted in some of the most sustained innovation and progress in the field.

Fatima: And that if none of us stopped to collect and archive this information, all those insights, lessons learned, and pearls of wisdom could just disappear.

Juliana: So we began to sit down for conversations with folks around the world to learn about their organic geochemistry pathways and careers.

Fatima: So today, it's our pleasure to kick off BIOmarkers with Dr. Clifford Walters — a longtime member of the organic geochemistry industry, co-author of The Biomarker Guides, and senior researcher currently at ExxonMobil.

> *Cliff: I'm a petroleum geochemist. I've been working in industry since I graduated from graduate school, brought down several oil companies and working on the big one now.*
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> *I actually started up the biomarker program at Gulf. They had no concept of biomarkers until, 'til I came. And that was, that was a real ey e opening experience for them.*

Fatima: Cliff's referring to the early 1980s, when gas chromatography-mass spectrometry used to identify and assess biomarkers was just gaining traction in the organic geochemistry community.

> *Cliff: My first experience with GCMS was on a Pond 492 and it was a magnetic sector instrument.*
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> *Cliff: It was easy in the early days because it was— everything was new. It was like, you know, if you had a GCMS you'd know yet another new biomarker.*
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> *It was easy back then. Nobody knew anything.*
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> *Now I'm in an enviable position, in that as being a senior scientist, I get to do anything I want. So right now, I think more than anything, I'm trying to broaden the scope of activities, research activities, that are being done at ExxonMobil.*

Juliana: But how did this all begin, given that the field was still so young? Why did Cliff end up at Gulf, at ExxonMobil?

Fatima: Cliff had a really confident answer for that:

> *Cliff: dumb luck. To be perfectly honest, when I was a kid, I was interested in all areas of science except geology. I thought geology was incredibly boring.*
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> *I started at grad school with the idea of going into biochemistry. And I was, so I showed up day one, and the professor goes, I just got a NASA grant, studying Viking Mars or, you know, simulation. You want to do that? And, you know, I said, Okay. And he goes, oh you're gonna probably be good to transfer over to geochemistry as a major. I go, okay. And that's how I ended up in geochemistry. Now, by the time I finished my coursework and got into actual research, they decided that there was no organics on Mars. And there was no longer a project to work on.*

Angel: We know that’s no longer true, and organic geochemical analysis is now a crucial aspect in the search for ancient life on Mars.

Fatima: So when Cliff’s Mars work ended, he shifted to Precambrian rocks in Greenland, and eventually made his way into petroleum.

Juliana: And the rest is history — Cliff’s since operated at the intersection of industry and research, and he’s noticed some trends over time.

> *Cliff: I think in the old days, as in like 15 years ago, the industry was much more active in terms of even basic research. And the meetings were pretty balanced in terms of what you will see in terms of really, really good cutting edge stuff from both industry and academia.*
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> *Most oil companies have shut down their research and things and they're not even funding academic research that much anymore.*
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> *A lot of the papers that I see that are from the petroleum side are case studies. They're not novel. They're not very, you know, exciting.*
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> *And I think actually, you know, it's— you can learn a lot through the more modern sediment stuff and you know, it can provide interesting leads and industry is hurting themselves by not not participating as much as they are.*

Fatima: But at the same time, he says there are still some notable advantages to working in industry.

> *Cliff: I've had this conversation many times, usually at Gordon Research Conferences with, you know, people from academics like, “How can you work for industry? You have no freedom to do anything you want.” And I tell them, “I don't have to apply for grants. I can buy just about any equipment that I want.”*
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> *And they leave me totally alone. I do whatever I want. Now you tell me what freedom I'm lacking in terms of, you know, as I say, at the same token, what are you doing?*
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> *You're doing paleoclimate work, because that's where the grant money is. Now, I said, I'm in a senior scientist position, and so I have a little more freedom to do that. But I have a lot more freedom than other people. And I'm kind of an anomaly in terms of geochemistry that way.*

Angel: And as part of that freedom, Cliff's been exploring the techniques he believes will drive the field forward.

> *Cliff: Right now, we're investing considerable effort in cryo AFM. We can actually image individual molecules and It's quite exciting. So a lot of a lot of iffy things like in the promises like, well, what's the structure? Well just look at it. And the ones that we image, It's uncanny. It looks like you got ChemDraw. You know, in fact, if I did a ChemDraw and like, you know, Photoshop, I could fake an image quite easily, because it's that that's what it looks like. The atoms are little balls. And, and the bonds are like, you know, lines. It's utterly amazing*
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> *The other thing that I would say is, I think, at this point in time, the ability to do the big data is going to be really, really, really critical. So I mean right now I'm working with LCMS data sets with like 9000 components per run. And we're looking at like a series of artificially mature at different temperatures. So I have these two hour runs, 9000 peaks in each with you know, triplicate runs and blanks and duplicates and standards run me that I had to go out and buy a bigger computer. My 32 gigabyte of RAM computer could not do it. So I now have a 760 gigabyte RAM PC. Are you gonna play Fortnite on it now? (laughs)*
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> *But the thing is, you say, You know why God, that's ridiculous, you know, a 16 core processor, say, Hewlett Packard. But in the big scheme of things, it' s $24,000 for a single PC, okay, it sounds excessive. But the flip side was I was spending seven days Just loading data to find out the end of the seven days i t failed.*
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> *You know, I'm wasting more time than the cost of this piece. And of course, I'm not going to be the sole user of the, of that PC. There's there's a lot of big data applications.*

Fatima: And speaking of big data and innovating forward…

> *Cliff: So we have a big genomics group now, doing microbial genomics.*
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> *So big data and the ability to intelligently manipulate that big data, whatever that big data set is. I think, if you develop skills in those areas, you could go in so many different directions. If you want you probably could go out of geochemistry completely and do quite well.*
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> *The big advances, the big jumps are all based on early adoption of some new technology. So, you know, the big jump in the biomarkers: G CMS. Big jump in isotypes: compound specific isotopic analysis. Polars: the big jump is Fourier*

transform mass spec. The whole— the whole GDGTs: LCMS. You take away LCMS, there's no GDGTs program, it's dead.

And it's one of the things also why I try to go to Goldschmidt now, because Goldschmidt has so much outside of organic geochemistry that you can, you can make these jumps. You know, somebody is doing something with optical microscopy and Raman and they're looking at mineral fluid inclusions. You know, you can say, wait a minute, has anybody looked at organics using this technique? And it's like, no, it's like, Oh, okay. So I like the novel technique sections. I like to see what the what the students are doing Because what they're doing is what's going to become kind of like the new paradigms for the next five years.

Juliana: And, to end today's episode, we asked Cliff: what makes a good organic geochemist?

Cliff: One, assume everything that has been done before is wrong. Because chances are it is. There is a reason why organic geochemistry is one of the longest running Gordon research conferences around. Because we never get to the right final answer. It's always cutting edge work. That one hand, it shows you how difficult things really are. I mean, if you really think of what we're trying to do, it's like we're trying to see millions if not billions of years in the past, looking at molecular fossils, or isotopic ratios, that had billions of years to change. And we're trying to make a story out of it, that it's mind boggling that we can we can even think that that's possible. That's what we do. So question everything.

Fatima: And there you have it, folks — question everything. Thanks so much for joining us today.

Next time, we'll speak with Tim Eglington about his career in organic geochemistry. To tune in, go to summons dot m-i-t dot edu backslash BIOmarkersPodcast. BIOmarkers is produced in the Summons Lab at the Massachusetts Institute of Technology.

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