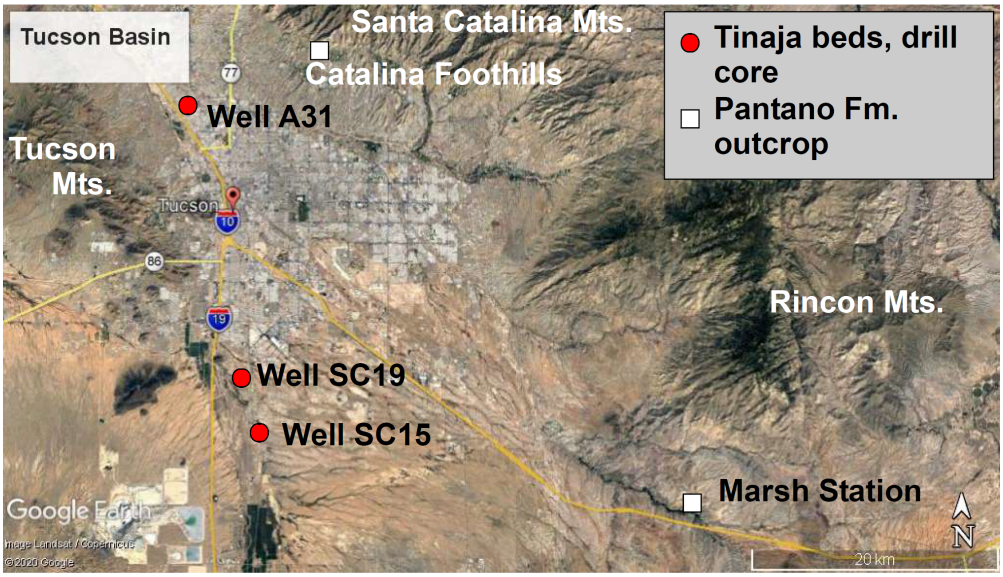

Figure S1. Satellite image of Tucson Basin, Arizona, showing sample sites.

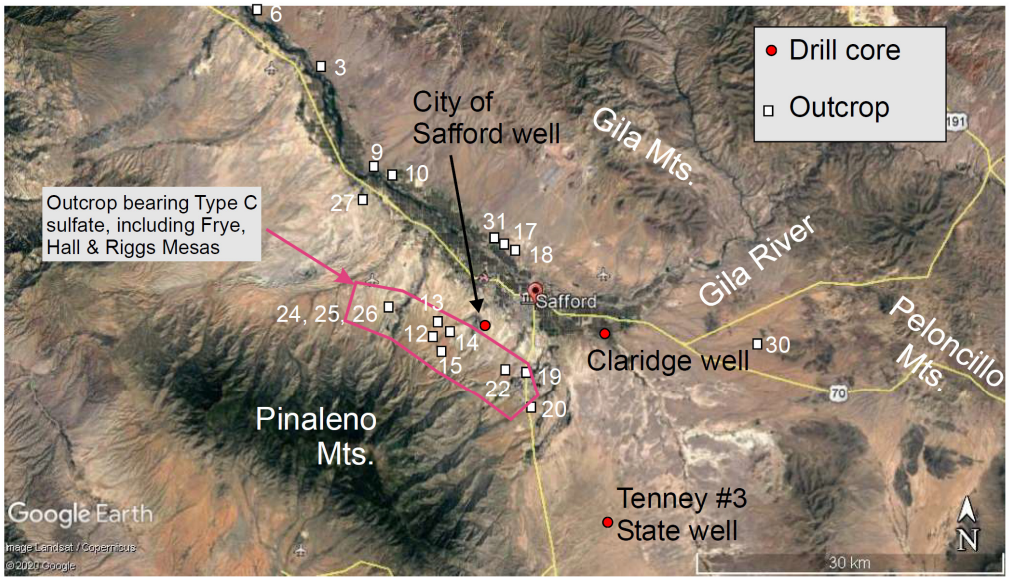

Figure S2. Satellite image of Safford Basin, Arizona, showing sample sites.

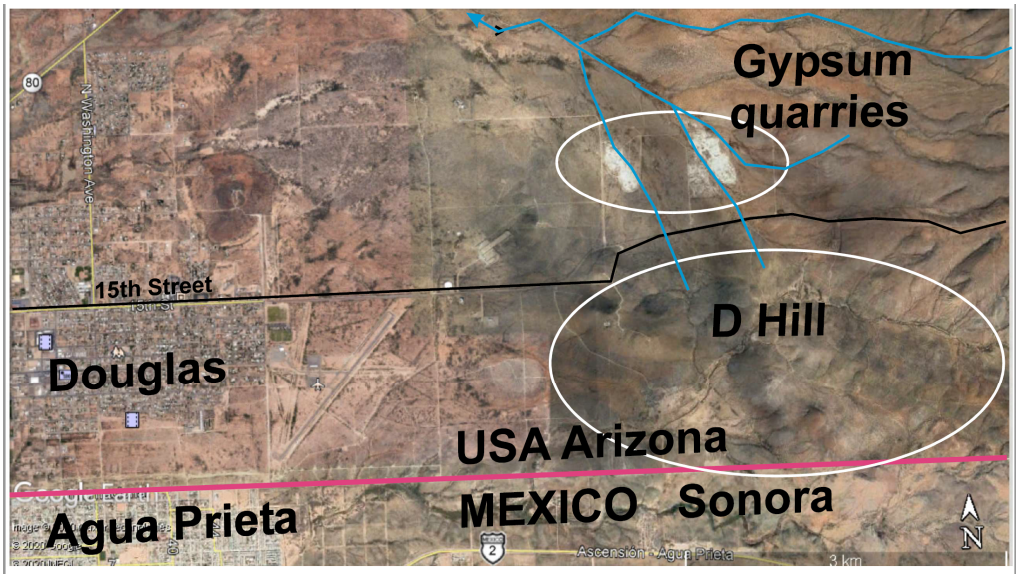

Figure S3. Satellite image of an un-named basin east of Douglas, Arizona, showing sample sites.

Table S1. Sample locations and new isotope data.				
Lab. No.	**Sample location**	**$\delta^{34}S$**	**$\delta^{18}O_{SO4}$**	**Sample description**
		‰	‰	
Picacho Basin, Exxon State (74)-1 Well				
S-4138	762.5-915.0	7.8	7.8	massive anhydrite
S-4139	915.0-1067.5	5.6		massive anhydrite
S-4140	1067.5-1220.0	6.0		massive anhydrite
S-4141	1220.0-1372.5	6.4		massive anhydrite
S-4142	1372.5-1525.0	9.5	8.4	massive anhydrite
S-4143	1525.0-1677.5	7.6		massive anhydrite
S-4144	1677.5-1830.0	8.2		massive anhydrite
S-4145	1830.0-1982.5	8.9		massive anhydrite
S-4146	1982.5-2135.0	7.8	11.8	massive anhydrite
S-4147	2135.0-2287.5	8.9		massive anhydrite
S-4148	2287.5-2440.0	9.2	14.7	massive anhydrite
Safford Basin, Tenney #3 State Well D(9-27)36cd				
S-4159	396.5-457.5	13.1	15.2	massive anhydrite
S-4160	547.5-518.5	12.4		massive anhydrite
S-4161	518.5-579.5	15.0		massive anhydrite
S-4162	579.5-640.5	16.2	12.3	massive anhydrite
S-4163	640.5-701.5	9.7		massive anhydrite
S-4164	701.5-762.5	9.8		massive anhydrite
S-4165	762.5-823.5	9.4	8.6	massive anhydrite
S-4193	823.5-884.5	8.2		massive anhydrite
S-4194	884.5-945.5	8.4	9.4	massive anhydrite
S-4195	945.5-1006.5	8.7		massive anhydrite
S-4196	1006.5-1037.0	9.2	9.8	massive anhydrite
Safford basin, Claridge Well				
S-4197	329.4-364.5	13.6	14.3	massive gypsum
S-4198	364.5-396.5	12.9		massive gypsum
S-4199	396.5-428.5	12.5		massive gypsum
S-4200	428.5-460.6	13.1		massive gypsum
S-4201	460.6-483.4	13.3		massive gypsum
S-4202	488.0-523.1	11.1	13.5	massive gypsum
S-4204	523.1-555.1	11.5		massive gypsum
S-4205	555.1-587.1	11.5		massive gypsum
S-4206	587.1-623.7	11.6		massive gypsum
S-4207	623.7-655.8	12.5		massive gypsum
S-4208	655.8-683.2	13.5		massive gypsum
Safford basin, City of Safford well D-7-25-27dad				
S-4151	95.5-131.5	-15.8	5.3	massive gypsum
S-4152	131.5-163.8	-13.9		massive gypsum
S-4153	187.3-231.5	-18.8		massive gypsum
S-4155	231.5-262.9	-4.9		massive gypsum
S-4154	262.9-299.2	-13.5		massive gypsum
S-4156	299.2-331.5	-13.0		massive gypsum
S-4158	331.5-367.8	-18.0	3.4	massive gypsum
Safford Basin, outcrop				
S-3806	Site 3	7.3		silty clay
S-3807	Site 6	9.1		bitter salt coating pyritic sediment
S-3808	Site 6	9.3		bedded gypsum
S-3810	Site 8	12.8		bedded gypsum
S-3814	Site 9	8.4		bedded gypsum
S-3811	Site 10	11.0		bedded gypsum
S-4338	Site 12	8.2		red sediment, upper
S-4334	Site 12	6.5		red sediment, lower
S-4354	Site 12	-30.2		ochre
(none)	Site 12	2.7		sediment
S-3920	Site 13	-27.2		bedded gypsum
S-3921	Site 13	-27.2	3.8	sediment

Lab. No.	Sample location	$\delta^{34}S$	$\delta^{18}O_{SO4}$	Sample description
		‰	‰	
Safford Basin, outcrop, continued				
S-3922	Site 13	-28.2		sediment
S-3923	Site 13	-26.8	4.8	sediment
S-3924	Site 13	-23.7		sediment
S-3925	Site 13	-26.7	2.4	bedded gypsum
S-3926	Site 13	-10.8		bedded gypsum
S-3927	Site 13	-17.0	7.5	sediment
S-3928	Site 13	-22.3		sediment
S-3929	Site 13	-27.2	2.7	sediment
S-3930	Site 13	-18.3		sediment
S-3932	Site 13	-24.9		sediment
S-3934	Site 13	-23.1		sediment
S-3978	Site 14	4.5		sediment
S-3979	Site 14	5.4		sediment
S-3980	Site 14	7.0		sediment
S-3981	Site 14	3.6		sediment
S-3812	Site 15	-11.0		gypsum vein
S-3815	Site 15	-12.6		clay
S-3813	Site 15	-12.9		bedded gypsum
S-3816	Site 15	-11.2		ochre
S-3818	Site 17	9.5		bedded gypsum
S-3935	Site 18	-21.9		bedded gypsum
S-3819	Site 19	-11.2		sediment
S-3820	Site 19	-7.6		ochre
S-3821	Site 19	-21.8		bedded gypsum
S-3474	Site 19	-20.9		ochre
S-4280	Site 20	6.6		lacustrine sediment
S-4281	Site 20	6.4		lacustrine sediment
S-4282	Site 22	3.1		lacustrine sediment (reddish sand.silt)
S-4283	Site 24	-11.0		rossette gypsum
S-4266	Site 25	2.5		lake sediment
S-4267	Site 25	4.0		lake sediment
S-4284	Site 25	5.1		lake sediment
(none)	Site 26	4.3		lake sediment (sand+clay layer)
S-4285	Site 26	1.2		bedded gypsum
S-4268	Site 27	-20.9		lake sediment (clay layer)
S-4270	Site 27	-28.8		lake sediment (green clay layer)
S-4271	Site 27	5.6		lake sediment (clay layer, salty)
S-4342	Site 27	5.8		lake sediment
S-4255	Site 30	9.2		bedded gypsum
S-3984	Site 31	11.2		lake sediment
S-3488	Site 31	10.2	3.1	lake sediment
S-3985	Site 31	11.1		lake sediment
S-4020	Site 31	8.8	10.0	lake sediment
S-3805	Site 31	9.5		lake sediment
S-4032	Site 31	7.9	10.1	lake sediment
S-4033	Site 31	9.8		lake sediment
S-4034	Site 31	9.5	12.6	lake sediment
S-4035	Site 31	6.5		lake sediment
S-4036	Site 31	9.1	7.2	lake sediment
S-4038	Site 31	8.9		lake sediment
S-4039	Site 31	6.4	5.7	lake sediment
San Pedro basin				
S-4359	Gypsum mine, Mammoth	8.6		bedded gypsum
S-4360	Gypsum mine, Mammoth	9.0	10.0	bedded gypsum
S-4361	Gypsum mine, Mammoth	8.7	11.4	bedded gypsum
S-4371	Gypsum mine, Mammoth	8.9		bedded gypsum
S-4373	Gypsum mine, Mammoth	8.4	10.1	bedded gypsum
S-4374	Gypsum mine, Mammoth	8.6		bedded gypsum
S-4372	Gypsum mine, Mammoth	9.0		bedded gypsum
QG	Copper Ck. Road, Mammoth	7.6	9.3	bedded gypsum
	West of St. David	11.1	12.8	bedded gypsum
S-17472	Threelinks Ranch, Cascabel	10.8	10.0	Na sulfates in lacustrine clay
S17914	Teran Wash, Cascabel	16.0	14.0	bedded gypsum, recrystallized
S17915	Teran Wash, Cascabel	17.1	16.8	bedded gypsum, recrystallized
S17916	Teran Wash, Cascabel	15.8	14	bedded gypsum, recrystallized

Lab. No.	Sample location	$\delta^{34}S$	$\delta^{18}O_{SO4}$	Sample description
		‰	‰	
Tucson Basin -- Pantano Formation				
S-3740	Marsh Station Rd.	12.0	15.0	bedded gypsum
S-3741	Marsh Station Rd.	11.3	15.6	gypsum vein
S-3889	Marsh Station Rd.	12.6	17.8	bedded gypsum
S-3742	Marsh Station Rd.	12.1	13.9	bedded gypsum
S-3891	Marsh Station Rd.	12.1	14.5	gypsum vein
S-3892	Marsh Station Rd.	9.3	12.2	gypsiferous clay
S-3890	Marsh Station Rd.	6.4	14.3	bedded gypsum
S-3743	Marsh Station Rd.	9.1	12.7	gypsum vein
Cat-1	Catalina foothills, N Campbell Ave.	6.9	12.0	bedded gypsum
Cat-2	Catalina foothills, N Campbell Ave.	6.8	12.9	bedded gypsum
Cat-3	Catalina foothills, N Campbell Ave.	8.4	12.6	bedded gypsum
Tucson Basin, Tinaja Beds, Tucson Water well SC19				
SC-19-1	472.8-475.8	6.2		massive gypsum
SC-19-2	533.8-536.8	7.6	8.5	massive gypsum
SC-19-3	625.3-628.3	6.0		massive gypsum
SC-19-4	747.3-750.3	5.6	7.0	massive gypsum
Tucson Basin, Tinaja Beds, Tucson Water well SC15				
SC-15-1	244.0-247.0	6.1	7.3	massive gypsum
SC-15-2	305.0-308.1	6.0		massive gypsum
SC-15-3	366.0-384.3	8.2	7.4	massive anhydrite
SC-15-4	457.5-475.8	7.5		massive anhydrite
SC-15-5	518.5-536.8	8.4	9.3	massive anhydrite
Tucson Basin, Tinaja Beds, Tucson Water well A31				
A-31-1	262.3-265.4	5.9	10.5	massive gypsum
A-31-2	280.6-283.7	7.4		massive gypsum
A-31-3	295.9-298.9	5.8		massive gypsum
A-31-4	308.1-311.1	6.4	11.4	massive gypsum
Unnamed basin (Douglas)				
S-3887	Gypsum mine	19.6		massive gypsum
S-3888	Gypsum mine	21.8	16.4	massive gypsum
S-4340	Gypsum mine	21.0	17.4	massive gypsum
S-4341	Gypsum mine	20.8	18.5	massive gypsum
S-3894	Limestone, D Hill	21.2		pyrite
S-3895	Limestone, D Hill	3.8		pyrite
S-3896	Limestone, D Hill	10.9		pyrite
Sed-1	Small drainage, D Hiill	15.5	3.3	Acid-soluble sulfate
Sed-2	Small drainage, D Hiill	16.3	11.6	Acid-soluble sulfate
Sed-3	Small drainage, D Hiill	16.8	10.2	Acid-soluble sulfate
Miscellaneous				
	Willcox Playa, Arizona	5.4		dissloved sulfate
	Animas Playa, New Mexico	4.6		dissolved sulfate
	Playa Guzman, Chihuaha	7.3		dissolved sulfate
	Salton Sea, California	5.6		dissolved sulfate
	White Sands, New Mexico	12.6		gypsum dune sand
	Fort Quitman (Fort Hancock Formation)	5.9		massive gypsum
	Fort Quitman (Fort Hancock Formation)	7.4		massive gypsum
Notes: Analytical precisions (1σ) are 0.13‰ for $\delta^{34}S$, and 0.4‰ for $\delta^{18}O$,				
except for numbers in red font, for which the analytical precison was 0.9‰.				