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Paper 32
Date: March 15, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ENERGYSOURCE MINERALS, LLC,
Petitioner,

v.

TERRALITHIUM LLC,
Patent Owner.

IPR2019-01602
Patent 9,650,555 B2

Before HUBERT C. LORIN, GRACE KARAFFA OBERMANN, and CHRISTOPHER G. PAULRAJ, *Administrative Patent Judges*.

LORIN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

This is a Final Written Decision in an *inter partes* review challenging the patentability of claims 1–18 of U.S. Patent No. 9,650,555 B2 (Ex. 1001, "the '555 patent"). We have jurisdiction under 35 U.S.C. § 6.

Petitioner has the burden of proving unpatentability of a claim by a preponderance of the evidence. 35 U.S.C. § 316(e). Having reviewed the arguments of the parties and the supporting evidence, we find that Petitioner has not demonstrated by a preponderance of the evidence that claims 1–18 are unpatentable.

A. Background

EnergySource Minerals, LLC ("Petitioner") filed a Petition requesting *inter partes* review of claims 1–18 of the '555 patent. Paper 1 ("Pet."). TerraLithium LLC ("Patent Owner") did not file a Preliminary Response to the Petition.

On March 17, 2020, we instituted an *inter partes* review, pursuant to 35 U.S.C. § 314(a). Specifically, we instituted an *inter partes* review of claims 1–18 on all asserted grounds of unpatentability. Paper 9 ("DI").

After institution, Patent Owner filed a Patent Owner Response (Paper 15, "PO Resp."); Petitioner filed a Reply (Paper 20, "Pet. Reply"); and Patent Owner filed a Sur-reply (Paper 24, "PO Sur-reply").

On December 15, 2020, the parties presented arguments at oral hearing, the transcript of which is of record. Paper 30 ("Tr.").

B. Related Proceedings

Petitioner indicates that it concurrently filed with the Petition in this case two other petitions for *inter partes* review of related U.S. Patent No. 9,644,126 and U.S. Patent No. 9,051,827. Pet. 1. These petitions correspond to IPR2019-01603 and IPR2019-01601, respectively.

According to Patent Owner:

> On September 11, 2019, Petitioner filed *inter partes* reviews of related U.S. Patent No. 9,051,827 (IPR2019-01601) and U.S. Patent No. 9,644,126 (IPR2019-01603). On October 1, 2019, Petitioner filed *inter partes* reviews of related U.S. Patent No. 8,454,816 (IPR2019-01604), U.S. Patent No. 9,057,117 (IPR2019-01605), U.S. Patent No. 8,518,232 (IPR2019-01606), and U.S. Patent No. 9,238,851 (IPR2019-01607).

Paper 4, 1.

Trial has been instituted in IPR2019-01603. Institution was denied in IPR2019-01601; IPR2019–01604; IPR2019–01605; IPR2019–01606; and IPR2019–01607.

C. The '555 patent (Ex. 1001)

1. Disclosure

The '555 patent "relates to treated brine compositions with reduced concentrations of silica and iron." Ex. 1001, code (54), 1:23–24. The '555 patent states that certain embodiments "also relate to geothermal brine compositions from which silica and/or iron have been selectively removed" and "[f]urther embodiments relate to brine compositions with reduced concentrations of silica and iron that may also be used for recovery of these metals, including lithium, zinc, manganese, and potassium." *Id.* at 1:30–36.

The '555 patent describes treated geothermal brine compositions that contain "a treated geothermal brine having a concentration of silica ranging from 0 to 80 mg/kg and a concentration of iron ranging from 0 to 300 mg/kg." *Id.* at 3:27–32. The '555 patent discloses another embodiment in which "the treated geothermal brine compositions described herein have a composition of arsenic ranging from 0 to 7 mg/kg." *Id.* at 4:28–30. The '555 patent also describes the use of treated geothermal brines, such as for extraction of minerals (e.g., lithium, manganese, potassium, rubidium,

cesium, phosphates, zinc, and lead). *Id.* at 4:43–50.

2. Claims

The '555 patent has 18 claims, all of which Petitioner challenges. Pet. 1.

Claims 1 and 15 are the independent claims. Claims 2–14 depend from claim 1 and claims 16–18 depend from claim 15. All but claims 10 and 11 are directed to a "treated geothermal brine composition." Claims 10 and 11 are directed to a "method of using" the composition of claim 1.

Independent claims 1 and 15, reproduced below, are illustrative.

> 1. A treated geothermal brine composition, the composition comprising a treated geothermal brine having a concentration of silica ranging from 0 to 80 mg/kg, a concentration of arsenic ranging from 0 to 7 mg/kg, and a concentration of iron ranging from 0 to 300mg/kg, and comprising recoverable amounts of one or more metals selected from the group consisting of lithium, manganese, rubidium, cesium and zinc or mixtures thereof.
>
> 15. A treated geothermal brine composition, the composition comprising a treated geothermal brine having a concentration of silica ranging from 0 to 80 mg/kg, a concentration of arsenic ranging from 0 to 7 kg, and a concentration of iron ranging from 0 to 300 mg/kg, and said geothermal brine is a Salton Sea brine, and comprising recoverable amounts of one or more metals selected from the group consisting of lithium, manganese, rubidium, cesium and zinc or mixtures thereof.

Ex. 1001, 42:26–33, 44:9–17. As can be seen, claim 15 includes the limitation "and said geothermal brine is a Salton Sea brine" but is otherwise the same as claim 1.

D. Asserted References

Petitioner relies on the following references:

Name	Reference	Ex. No.
Brown	U.S. Patent No. 5,358,700, issued Oct. 25, 1994	1005
Christopher	D. H. Christopher, The Recovery and Separation of Mineral Values from Geothermal Brines, Bureau of Mines OFR 81-75 (Jun. 12, 1975)	1006
Maimoni	Arturo Maimoni, "A Cementation Process for Minerals Recovery from Salton Sea Geothermal Brines," Lawrence Livermore Laboratory (Jan. 26, 1982)	1004
Okada	Hidehiko Okada, JP 3691027, published Nov. 11, 2003	1008[1]

E. Grounds Asserted

Petitioner contends that claims 1–18 of the '555 patent are unpatentable under the following grounds:

Claim(s) Challenged	**35 U.S.C.**	**Reference(s)/Basis**
1–18	§ 102	Christopher
1–18	§ 103	Christopher, Brown
1–18	§ 102	Maimoni
1–18	§ 103	Maimoni, Brown
1–18	§ 102	Okada
1–18	§ 103	Okada, Brown

Pet. 3–4.

[1] Ex. 1008 is a certified English language translation of Okada (Ex. 1007) submitted by Petitioner.

Petitioner also relies on the Declaration of Darrell L. Gallup, Ph.D. (Ex. 1003; "Gallup Declaration") as support for its patentability challenges.

Patent Owner relies on the Declaration of Stephen Harrison (Ex. 2002, "Harrison Declaration") as support for its contentions in opposing the patentability challenges.

II. ANALYSIS

A. Level of Ordinary Skill in the Art

There is general agreement as to the level of ordinary skill in the art. *See* Pet. 4 (citing Ex. 1003, ¶ 21) and PO Resp. 3 (citing Ex. 2002, ¶¶ 17–18). Consistent therewith, we determine that one of ordinary skill in the art at the time of the invention would have had at least an undergraduate scientific or engineering degree in a relevant field (such as chemistry, chemical engineering or metallurgy) and at least five years' experience in the hydrometallurgical industry.

B. Claim Construction

For petitions filed on or after November 13, 2018, "[claims] of a patent . . . shall be construed using the same claim construction standard that would be used to construe the [claims] in a civil action under 35 U.S.C. § 282(b), including construing the [claims] in accordance with the ordinary and customary meaning of such claims as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100 (2019); *see also Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc).

Petitioner proposes constructions for the claim terms "treated," "geothermal brine," and "treated geothermal brine" (Pet. 9–10); "Salton Sea brine" (*id*. at 10); "concentration ranges including '0' and 'less than'" (*id*. at

11–12); "a concentration of arsenic ranging from 0 to 7 kg" (*id*. at 12); and, "a recoverable amount" (*id*. at 13). Patent Owner responds to Petitioner's proposed constructions and does not propose constructions for other claim terms. PO Resp. 9–13. To the extent the meaning of any term requires discussion, we will provide it below in our analysis of the patentability challenges.

C. Anticipation – Christopher

Petitioner challenges claims 1–18 as anticipated under 35 U.S.C. § 102(b) by Christopher. Pet. 22–37.

1. Independent Claims 1 and 15

a. "A treated geothermal brine composition" (Claims 1 and 15); "the composition comprising a treated geothermal brine" (Claim 1)

Petitioner argues that Christopher describes a "treated" geothermal brine because, inter alia, the silica concentration is reduced. Pet. 23 (citing Ex. 1006, 8). Table 1 of Christopher is reproduced below.

Table 1

Typical Composition of Sinclair No. 4 Brine

Element	ppm	Element	ppm	Element	ppm	Element	ppm
Ag	0.5	Ce	10	Mn	2000	Se	2.5
Al	0.6	Cu	0.5	Mo	10	Si	40
As	3.	F	10	Na	70,000	SO_4	0.04
B	400	Fe	1200	Nb	0.1	Sr	600
Ba	200	Ga	0.5	NH_4	650	Ta	6
Br	200	Ge	1.	Ni	0.5	Ti	2.5
Ca	35,000	I	0.5	P	0.5	V	0.3
Cd	0.9	K	19,000	Pb	100	Zn	500
Cl	190,000	Li	250	Rb	25	Zr	8
Cr	2	Mg	150	S	0.1		

Table 1 of Christopher showing analytical data for a typical composition of Sinclair No. 4 brine.

Ex. 1006, 8. Petitioner also relies on the statement located below, associated with Table 1, which reads: "[i]t will be noted that the silica content of the

Sinclair No. 4 brine samples used averaged only 40 ppm, as contrasted to the normal value of 750 ppm obtained from fresh wellhead brine." Pet. 23; Ex. 1006, 8.

Neither party disputes that Table 1 of Christopher describes an "aged" geothermal brine. PO Resp. 13–15 (citing Ex. 2002, ¶ 51, Ex. 2025, 217:2–6, Ex. 1006, 8–9). Pet. Reply 6 ("Christopher's 'aged' brine").

The question is whether Christopher's "aged" brine is a "treated" brine as the claims call for. This requires us to construe the term "treated."

In that regard, Petitioner proposes that the term "treated" be construed as defined in the '555 patent. Pet. 9 (citing Ex. 1001, 7:18–21).

"[I]f the patentee has chosen to be his or her own lexicographer by clearly setting forth an explicit definition for a claim term," then that definition of the term controls. *Johnson Worldwide Associates, Inc. v. Zebco Corp*., 175 F.3d 985, 990 (Fed. Cir. 1999).

> Here the '555 patent provides an explicit definition for "treated":
>
> The term "treated" in reference to a brine (e.g., "treated brine" or "treated geothermal brine") refers to brines that have been processed such that the concentration of at least one metal or elemental component has been reduced in the brine.

Ex. 1001, 7:18–24. We agree with Petitioner that this definition of "treated" controls.

Patent Owner proposes a more narrow meaning for "treated," arguing that the '555 patent describes a "treated" brine as having been flashed and then processed to remove iron. PO Resp. 5–6 (citing Ex. 2002, ¶ 31–36, Ex. 1001, 32:41–51).

The passage Patent Owner relies upon is an example treatment. PO Resp. 4–5 (citing Ex. 1001, 32:41–43 (discussing "Example 6")). While the

technique for producing "treated" geothermal brine per the example is consistent with the explicit definition for "treated," it does not compel defining "treated" more narrowly. The definition for "treated" is already clear to one of ordinary skill in the art. Relying on said example would unnecessarily import a further limitation beyond what is required by the explicit definition set forth in the patent. This is improper. *Cf. E.I. du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 1433 (Fed. Cir. 1988) ("a limitation read into a claim from the specification wholly apart from any need to interpret what the patentee meant by particular words or phrases in the claim" is improper)

We now turn to the question of whether the "treated" brine of the claims reads on Christopher's "aged" brine within the meaning of the term "treated" as explicitly defined in the '555 patent.

To meet the claims, the brine of Table 1 must "have been processed such that the concentration of at least one metal or elemental component has been reduced in the brine." Ex. 1001, 7:18–21.

In that regard, Petitioner contends that Christopher's "aging process resulted in a reduction in 'at least one *elemental component' (i.e., silica)*." Pet. Reply 6 (emphasis added). However, this is not buttressed with any evidence.

Petitioner has not presented any evidence showing Christopher's "aging" process reduces "the concentration of at least one … *elemental component*" to support its contention that Christopher's brine of Table 1 is a "treated" brine as claimed.

Accordingly, on this record, Petitioner has not shown that the "treated" brine of the claims reads on Christopher's "aged" brine by a preponderance of the evidence.

b. "said geothermal brine is a Salton Sea brine" (Claim 15)

We accept Petitioner's contention, which is not opposed by Patent Owner and is supported adequately by objective evidence, that Christopher discloses brines obtained from wells in Imperial Valley, California, which are "Salton Sea" brines in accordance with the definition expressly provided for in the '555 patent. Pet. 28 (citing Ex. 1003, ¶ 158), Ex. 1001, 7:15–17. *See generally* PO Resp. 5–6 and 12–25.

c. "having a concentration of silica ranging from 0 to 80 mg/kg" (Claims 1 and 15)

Petitioner argues that Christopher describes a brine having a concentration of silica in the claimed range. Pet. 23–27. Petitioner relies on Table 1 (reproduced above), Table 3 and Figure 20 (reproduced below). *Id.*; Ex. 1006, 8, 12, 42.

With respect to Table 1, Petitioner contends that it shows silica at 40 ppm and that this concentration is within the range claimed. Pet. 23; Ex. 1006, 8. According to Petitioner, "1 ppm is the same as 1 mg/kg. EX 1003, ¶49." Pet. 12.

Patent Owner argues that Table 1 reports the 40 ppm for "Si" but it is unclear that "Si" refers to "silica." PO Resp. 15–17.

Petitioner argues that "Si" refers to silica because Christopher "reports silica (SiO2), not once but twice" in the text immediately following Table 1. Pet. Reply 7; Ex. 1006, 8.

Patent Owner has the stronger argument.

It is true that "silica" is recited in the statement below Table 1. Pet. 23; PO Resp. 17; Ex. 1006, 8 ("silica content of the Sinclair No. 4 brine samples used averaged only 40 ppm … ."). But, as Patent Owner points out, "Dr. Gallup conceded [that] it is possible that Table 1 provides a silicon

analysis and Christopher simply forgot to apply the conversion factor in his text below the table. (Ex. 2025, 183:1-19; Ex. 2002, ¶56)." PO Resp. 17. "Additionally, Dr. Harrison testified that '[s]cientists typically determine silica content by analyzing for elemental silicon,' which is consistent with reading Christopher's Table 1 as reporting the amount of silicon, not silica." Ex. 2002 ¶ 55; PO Resp. 16.

Petitioner responds by arguing, *inter alia*, that "Dr. Harrison was unable to challenge the reported 750 ppm silica value" in the statement below Table 1. Pet. Reply 7 (citing Ex. 1011, 150:9–14). But that does not help narrow down what "Si" in Table 1 is referring to. Petitioner does not provide, for example, evidence of that one of ordinary skill in the art reading Table 1 would have understood "Si" to mean silica.

Since Petitioner has not presented any evidence as to the understanding of one of ordinary skill in the art reading "Si" in Table 1, Table 1 insufficiently supports Petitioner's contention that Christopher describes a brine having a concentration of silica in the claimed range.

With respect to Table 3 and Figure 20, Petitioner acknowledges that "Table 3 or Figure 20 of Christopher do not recite a concentration for silica." Pet. 25; Ex. 1006, 42. Accordingly, Petitioner does not establish that the combined disclosures of Table 3 and Figure 20 indicate that Christopher describes a brine having a concentration of silica in the claimed range.

Table 3 of Christopher is reproduced below:

Table 3

Purification of Brine by Precipitation of Heavy Metal Hydroxides

Element	Concentration: Feed Brine g/l	Concentration: Product Brine g/l	Concentration: Washed and Dried Product Solid Wt, %
Ba	0.223	0.207	0.002
Ca	34.6	36.6	12.4
Pb	0.139	<0.001	1.52
Li	0.255	0.261	0.06
Mg	0.150	0.0014	2.09
Mn	1.63	0.002	17.3
Fe	0.88	0.0053	11.0
Na	69	86	0.0088
Sr	0.710	0.719	0.009
K	19.1	18.7	0.007
Zn	0.497	0.004	6.03
SO_4	0.042	<0.001	-
NH_4	0.797	0.007	-

Table 3 of Christopher shows analytical data for feed and product brines and washed/dried solid product.

Ex. 1006, 12 (reproduced at Pet. 24).

Figure 20 of Christopher consists of a flowchart showing a process by which "Sinclair #4 Brine" feed passes through three precipitation units. After each unit, the flowchart states "Liquor" and a number is assigned to each, from 2 to 4; the feed is assigned the number 1. At the bottom left of Figure 20 is this table:

LIQUOR	CONCENTRATION, PPM: Mn	Fe	Zn	Pb	Li
① FEED	2000	1810	805	120	
② IRON PRECIP. DISCH.	2000	20	780	110	
③ Mn PRECIP. DISCH.	<1.0	1.0	5.0	5.0	440
④ PRODUCT BRINE	<1.0	<1.0	<1.0	<1.0	4.6

Table in Figure 20 of Christopher showing analytical data for the feed and liquor brines.

Ex. 1006, 42 (reproduced at Pet. 24). It is this table in particular that Petitioner is referring to.

Even though Table 3 and Figure 20 do not mention silica, Petitioner argues that Figure 20 shows Christopher's process reducing the iron concentration from 1810 ppm to 1.0 ppm or less, and the silica concentration would necessarily reduce along with it, i.e., ", falling from 40 ppm to a concentration at or near 0 ppm". Pet. 25 (citing Ex. 1006, 42).

Petitioner relies on (a) the statement at 19:1–6 of the '555 patent (Ex. 1001) and (b) ¶¶ 150–157 of Dr. Gallup's declaration (Ex. 1003) to show that Christopher's process necessarily reduces silica concentration as iron concentration reduces. Pet. 25.

Regarding (a), the '555 patent states that arsenic (III) and (V) oxyanions, for which iron (III) hydroxide *may* have a significant affinity, if present in the brine, *may* be co-deposited with the silica on the iron (III) hydroxide. Ex. 1001, 19:1–6 (emphasis added). We agree with Patent Owner that "[t]he statement from the '555 patent, upon which Petitioner relies as support for its position, uses the terms 'may have' and 'may be' and does not provide a definitive teaching to support Petitioner's allegation of inherency. (Ex. 2002, ¶67)." PO Resp. 23.

Petitioner submits that "the Board should accept as true the admissions in the '555 patent that at least iron, silica, and arsenic are known to a POSITA [person of ordinary skill in the art] to co-precipitate under the prescribed conditions." Pet. Reply 8. But the '555 patent does not state that at least iron, silica, and arsenic co-precipitate under the prescribed conditions, only that they *may* co–precipitate.

Accordingly, 19:1–6 of the '555 patent does not sufficiently support Petitioner's position that Christopher's process would necessarily reduce the concentration of silica in the brine.

Regarding (b), Dr. Gallup testifies that "[b]ecause the concentration of iron decreases in Christopher from 1810 ppm to 1.0 ppm or less (EX 1006, at 42 [i.e., Fig. 20]), it follows that the concentration of silica would also fall from 40 ppm at the post-flash feed (*Id*., at 8) to a concentration at or near 0 ppm in the Discharge Liquor (3) or the Product Brine (4)." Ex. 1003, ¶ 150. Pet. 25.

But Dr. Gallup qualifies that "[i]n my opinion, a POSITA could easily tune the parameters of the process [of Christopher] to yield a treated geothermal brine free of silica and iron." Ex. 1003, ¶ 157. PO Resp. 24.

We understand from Dr. Gallup that a person of ordinary skill in the art "could [have] readily 'tuned'" Christopher's process to achieve a result as claimed, as Petitioner argues. Pet. Reply 9. But that proves there is a difference between what Christopher describes and what is claimed, albeit the difference may be slight without the need for extensive tuning. Pet. Reply 9. "[D]ifferences between the prior art reference and a claimed invention, however slight, invoke the question of obviousness, not anticipation." *Net MoneyIN, Inc. v. VeriSign, Inc*., 545 F.3d 1359, 1371 (Fed. Cir. 2008).

Petitioner's other arguments are similarly undermined. For example, Petitioner argues that according to Dr. Gallup there is a 1:1 correlation between silica and iron based on his experience. Pet. Reply 9. Yet the "exact molar correlation between silica and iron will vary based on temperature, pH, and agitation." *Id*. Further undermining Petitioner's position, Dr. Gallup testified that he agrees that the relative level of silica as

a result of it reacting with iron "is just based on probabilities and possibilities." Ex. 2025, 240:11–18; PO Resp. 24.

Accordingly, ¶¶ 150–157 of Dr. Gallup's declaration also does not sufficiently support Petitioner's position that Christopher's process would necessarily reduce the concentration of silica in the brine.

Since Petitioner has not presented sufficient evidence showing Christopher's process necessarily reduces the concentration of silica to within the claimed range as it reduces the iron concentration from 1810 ppm to 1.0 ppm or less, and since that is the basis for arguing that Table 3 and Figure 20 describe silica at a concentration within the claimed range, Table 3 and Figure 20 insufficiently support Petitioner's contention that Christopher describes a brine having a concentration of silica in the claimed range.

Finally, to the extent Petitioner looks to Table 1 to remedy Table 3 and Figure 20, it is unavailing. Pet. 27 (citing Ex. 1003, ¶ 162). As Patent Owner demonstrates via a chart, reproduced in its Response, the brine of Table 1 and feed stream 1 of Figure 20 are different compositions. PO Resp. 21, citing Ex. 1006, 8, 42; Ex. 2002, ¶ 65. Petitioner concedes as much. Pet. Reply 8–9 ("It is true that the brine concentrations 'do not match up' (POR, 19), nor would a POSITA expect the constituent concentrations of an averaged brine to 'match' the constituent concentrations of an actual geothermal brine sample. (EX 1011, 161:23-162:10)."). One of ordinary skill in the art would have to resort to picking and choosing from disparate disclosures of brine compositions and even then it is not clear that one of ordinary skill in the art would necessarily reach a composition as claimed.

For the foregoing reasons, Petitioner has not shown that Christopher describes a brine having silica in a concentration in the claimed range by a preponderance of the evidence.

d. "a concentration of arsenic ranging from 0 to 7 mg/kg" (Claims 1 and 15)

Similar to the silica limitation, Petitioner argues that Christopher describes a brine having a concentration of arsenic in the claimed range, relying on Table 1, Table 3 and Figure 20. Pet. 27; Ex. 1006, 8, 12, 42.

With respect to Table 1, it is undisputed that it records an arsenic concentration of "3. ppm" which falls within the claimed range of "from 0 to 7 mg/kg" (Ex. 1001, 42:29). Pet. 23, 27; Ex. 1006, 8.

With respect to Table 3 and Figure 20, it is evident that neither recites a concentration for arsenic. Ex. 1006, 42. As with the silica limitation, Petitioner argues that Christopher's process necessarily reduces arsenic to a concentration within the claimed range iron concentration as the iron concentration is reduced. Pet. 27. Since Petitioner has not presented sufficient evidence showing Christopher's process necessarily reduces the concentration of arsenic to within the claimed range as it reduces the iron concentration from 1810 ppm to 1.0 ppm or less, and since that is the basis for arguing that Table 3 and Figure 20 describe arsenic at a concentration within the claimed range, Table 3 and Figure 20 insufficiently support Petitioner's contention that Christopher describes a brine having a concentration of arsenic in the claimed range.

To the extent Petitioner looks to Table 1 to remedy Table 3 and Figure 20 for their lacking to mention arsenic, it is unavailing for the reasons discussed earlier in finding such a remedy unavailing to meet the claimed silica concentration.

Petitioner has not shown that Christopher describes a brine having arsenic in a concentration in the claimed range by a preponderance of the evidence.

e. "a concentration of iron ranging from 0 to 300mg/kg" (Claims 1 and 15)

Petitioner argues that Table 3 shows a brine "having an iron concentration of 0.0053 g/L (4.5 mg/kg)" which falls within the claimed range. Pet. 28 (citing Ex. 1006, 12). According to Petitioner, 0.0053 g/L equates to 4.5 mg/kg. *Id*., fn. 3 ("mg/kg=(g/L*1000)/1.18kg/L due to the density of Salton Sea geothermal brines.").

Patent Owner argues that "a POSITA would need the density of the brine in order to make the conversion." PO Resp. 18, citing Ex. 2002, ¶ 60; Ex. 2025, 335:24–336:2. Patent Owner takes issue with the density value in the footnote the Petitioner uses as the basis for converting 0.0053 g/L to 4.5 mg/kg. According to Patent Owner, said density "is unsupported by any reference, and Petitioner did not even cite to its own expert for the statement. (Ex. 2002, ¶61)." PO Resp. 18 (referring to Pet. 28, fn. 3). According to Patent Owner, "[i]n his deposition, Dr. Gallup admitted that ***he did not know the density*** of a Sinclair No. 4 brine and based a value 'close to 1.18' on an assumption." *Id*. (citing Ex. 2025, 337:4–12).

We agree with Patent Owner. To ascertain whether Table 3 describes iron having a concentration in the range claimed, the 0.0053 g/L value must be converted to mg/kg and that entails knowing the density of the geothermal brine associated with Table 3. In that regard, "Christopher does not provide any density values that would allow a POSITA to make this calculation." *Id*. (citing Ex. 2002, ¶ 61). The density value that Petitioner uses, i.e., 1.18kg/L, is unsupported by evidence.

Accordingly, the density of the geothermal brine associated with Table 3 is uncertain. Although it is possible that one of ordinary skill in the

art might apply a density of 1.18kg/L, a case of inherency cannot resort to relying on possibilities and probabilities.

For the foregoing reason, Table 3 insufficiently supports Petitioner's contention that Christopher describes a brine having a concentration of iron in the claimed range.

Petitioner also contends that "[s]imilarly, in the example described in Figure 20, the concentration of iron in the treated brine stream (3) is 1 ppm or less. [Ex. 1006], at 42." Pet. 28.

However, as Patent Owner argues, it is unclear whether Christopher's disclosure of "1 ppm" for iron refers to ppm by volume or ppm by weight as the claims call for. PO Resp. 20. According to Patent Owner, "Dr. Gallup explained [that] ppm may be reported as ppm by weight or ppm by volume. (Ex. 2025, 119:16-25; Ex. 2002, ¶64)." *Id*.

Because we are directed to no evidence contradicting it, we credit Dr. Gallup's testimony that ppm can be reported by weight or by volume. Given this, one of ordinary skill in the art reading that iron is at a concentration of "1.0 ppm" for stream 3 in Figure 20 may understand it to refer to ppm by volume.

Accordingly, whether the "1.0 ppm" recited in Figure 20 refers to weight is uncertain. Although it is possible that one of ordinary skill in the art would understand it to mean ppm by weight, a case of inherency cannot resort to relying on possibilities and probabilities. *In re Olerich*, 666 F.2d 578, 581 (CCPA 1981).

For the foregoing reason, Figure 20 insufficiently supports Petitioner's contention that Christopher describes a brine having a concentration of iron in the claimed range.

We note that Patent Owner also argues that Petitioner improperly combines Table 1 and Table 3. PO Resp. 18. However, Petitioner's analysis does not rely on Table 1. Pet. 28.

Petitioner has not shown that Christopher describes a brine having iron in a concentration in the claimed range by a preponderance of the evidence.

> *f. "recoverable amounts of one or more metals selected from the group consisting of lithium, manganese, rubidium, cesium and zinc or mixtures thereof." (Claims 1 and 15)*

We accept Petitioner's contention, which is not opposed by Patent Owner and is supported adequately by objective evidence, that Christopher discloses brines with recoverable amounts of lithium. Pet. 29. *See generally* PO Resp. 12–25.

g. Conclusion

Because Petitioner has not shown that the "treated" brine of the claims reads on Christopher's "aged" brine and has not shown that Christopher describes a brine having silica, arsenic, and lead in concentrations in the claimed ranges by a preponderance of the evidence, Petitioner has not shown that Christopher describes, expressly or inherently, the composition of claims 1 and 15.

2. Dependent Claims 2–14 and 16–18

Having found that Petitioner does not prove by a preponderance of the evidence that independent claim 1 or 15 are unpatentable based on anticipation by Christopher, we find that Petitioner has also failed to prove that any of the dependent claims are unpatentable on that same ground.

Patent Owner raises an additional reason why claim 11 is not proven unpatentable. Claim 11 is directed to a method of using a treated geothermal

brine composition comprising "steps of injecting the composition of claim 1 into a geothermal reservoir." Ex. 1001, 43:26–27.

According to Patent Owner, Petitioner "admit[s] that Christopher does not disclose this step. (Pet., 33; Ex. 2002, ¶73)." PO Resp. 26. We agree because Petitioner contends that "although Christopher does not explicitly describe the process for reinjecting treated geothermal brines into a geothermal reservoir, this step is admitted as prior art by the '555 patent." Pet. 33. By relying on material outside the four corners of Christopher to show the claimed subject matter, Petitioner effectively concedes that Christopher alone does not describe it.

Petitioner responds by arguing that "the specification demonstrates that reinjection into the geothermal reservoir would have been commonly known to a POSITA." Pet. Reply 10, citing Ex. 1001, 2:67–3:2. Petitioner also states that "[b]oth Dr. Gallup and Dr. Harrison testified that it was known to reinject geothermal brines into a geothermal reservoir via an injection well." *Id*., citing Ex. 1011, 22:1124:10, 65:10–66:20, 77:18–20, 80:11–81:5, 87:24–88:11; Ex. 2025, 224:5–12. But the question here is one of anticipation. The question is not whether the claimed reinjection would have been obvious over Christopher given the common knowledge that treated geothermal brines may be reinjected into a geothermal reservoir.

Accordingly, for this additional reason, Petitioner has not shown that Christopher describes, expressly or inherently, the claimed method of using the composition of claim 11 by a preponderance of the evidence.

D. Obviousness – Christopher and Brown

Petitioner challenges claims 1–18 as obvious under 35 U.S.C. § 103(a) over the combination of Christopher and Brown. Pet. 22–37.

1. Independent Claims 1 and 15

Petitioner asserts that Claims 1 and 15 are "rendered obvious over Christopher (EX 1006) in view of Brown (EX 1005)." Pet. 22.

Petitioner does not explain how the combination of Christopher and Brown overcomes the deficiencies in Christopher identified earlier in addressing the anticipation ground; namely, that Christopher describes an "aged" brine rather than a "treated" brine and does not show a brine having silica, arsenic, and lead in concentrations in the claimed ranges.

For that reason, Petitioner has not shown that the combination of Christopher and Brown renders obvious the composition of claims 1 and 15 by a preponderance of the evidence.

That being said, the only aspects of claims 1 and 15 that Petitioner discusses in the context of this obviousness ground are the limitations "said geothermal brine is a Salton Sea brine" (claim 15; *see* Pet. 29) and "a concentration of silica ranging from 0 to 80 mg/kg" (claims 1 and 15; *see* Pet. 25–27). We have already found that Christopher describes a Salton Sea brine.

Regarding the silica concentration, Petitioner argues that, "[e]ven if Christopher is somehow interpreted to disclose a concentration range of silica that is *higher* than 80 mg/kg, it would have been obvious to a POSITA in view of the Brown to reduce the silica concentration range to a level below 80 mg/kg to avoid silica scaling concerns." Pet. 25.

We are not placed in a position to do a meaningful review of this argument because Petitioner does not identify the disclosure in Christopher that may "somehow [be] interpreted to disclose a concentration range of silica that is higher than 80 mg/kg" and thus has not established the starting point of its obviousness argument. Pet. 25.

Petitioner has not shown that the combination of Christopher and Brown renders obvious the composition of claims 1 and 15 by a preponderance of the evidence for the earlier stated reason.

2. Dependent Claims 2–14 and 16–18

Having found that Petitioner does not prove by a preponderance of the evidence that independent claim 1 or 15 are unpatentable based on this obviousness ground, we find that Petitioner has also failed to prove that any of the dependent claims are unpatentable on that same ground.

E. Anticipation – Maimoni

Petitioner challenges claims 1–18 as anticipated under 35 U.S.C. § 102(b) by Maimoni. Pet. 38–51.

1. Independent Claims 1 and 15

a. "A treated geothermal brine composition" (Claims 1 and 15); "the composition comprising a treated geothermal brine" (Claim 1)

We accept Petitioner's contention, which is not opposed by Patent Owner and is supported adequately by objective evidence, that Maimoni discloses brine with reduced concentration of metals resulting from processing flashed geothermal brine from the Magmamax No. 1 well and that that is a "treated geothermal brine" as claimed. Pet. 38; Ex. 1004, 15, Figure 5. *See generally* PO Resp. 37–48.

b. "said geothermal brine is a Salton Sea brine" (Claim 15)

We accept Petitioner's contention, which is not opposed by Patent Owner and is supported adequately by objective evidence, that Maimoni discloses brines obtained from wells at the Salton Sea and that they are a Salton Sea brine as required by claim 15. Pet. 43 (citing Ex. 1004, 7–8).

c. "having a concentration of silica ranging from 0 to 80 mg/kg" (Claims 1 and 15)

The parties dispute whether the silica concentration disclosed in Maimoni can be relied upon to show that Maimoni's brine includes silica at a concentration within the claimed range.

Petitioner argues that Table 5 and Figure 5 of Maimoni show silica "drop[ping] to about '22 ppm' on Stream No. 11 leaving the iron thickener unit" which is within the claimed range. Pet. 39; Ex. 1004, 15–17, Table 5 and Figure 5. Table 5 of Maimoni is reproduced below.

Table 5. Process flow sheet for Magmamax No. 1 brine (Hazen Research, Inc.).

	Stream No.											
	1	2	3	4	5	6	7	8	9	10	11	12
SiO_2	230 ppm total 187 ppm solid	1.6 lb/h 10.2 wt%	1.6 lb/h 60 wt%	43 ppm				43 ppm	0.16 lb/h solids		22 ppm	
Fe	255 ppm			255 ppm				255 ppm total	375 lb/h solids		26 ppm	
Zn	333 ppm			333 ppm				333 ppm			333 ppm	
Mn	775 ppm			775 ppm				775 ppm			775 ppm	
Pb	70 ppm			70 ppm				70 ppm	0.13 lb/h solids		56 ppm	
Li	182 ppm			182 ppm				182 ppm			182 ppm	
Inertia	22.1%			22.1%				22.1%			22.1%	
H_2O	77.7%			77.7%			7 lb/h	77.7%			77.1%	
Specific grey	1.135	1.20		1.135	1.22			1.14	1.32	1.9	1.13	1.22
Temp. °C	93	93	93	93	25	29	92	92	92	92	92	25
Temp. °F	200	200	200	200	77	85	198	198	198	198	198	77
Flow, gpm	15	0.025		15	0.025			15	0.03		15	0.088
Flow, gph	900	1.5		900	1.50			901	1.8		901	5.25
Flow, cfm	–	–				5.0	6.2					
Flow, lb/h	8523	15.0	2.67	8520	15.3			8528	20	6.8	8508	54
Specific heat Btu/lb °F	0.85	0.78	0.46	0.85	0.77			0.85		0.48	0.85	0.77
Heat Btu/h	1.45×10^6	2340	2.46	1.45×10^6	2471			144×10^6		646	144×10^6	10,656
Density	9.47 lb/gal	9.99 lb/gal	≈50 lb/ft^3	9.47 lb/gal	10.2 lb/gal			951 lb/gal	11.0 lb/gal	15.8 lb/gal	944 lb/gal	10.2 lb/gal
NH_3	352 ppm			352 ppm				352 ppm			352 ppm	
	Post-flash Magmamax No. 1 brine input	SiO_2 thickener underflow at 11 wt% solids	SiO_2 filter cake	Brine feed to iron reactor	40% w/v $Ca(OH)_2$ slurry	Air sparge to iron reactor	Vent gases from iron reactor	Iron slurry to thickener	Iron thickener underflow at 20 wt% solids	Iron filter cake	Iron thickener overflow	40% w/v $CA(OH)_2$ slurry

	Stream No.											
	13	14	15	16	17	18	19	20	21	22	23	24
SiO_2												
Fe			26 ppm	0.21 lb/h		13 ppm			13 ppm			13 ppm
Zn			333 ppm	4.11 lb/h		17 ppm			17 ppm			17 ppm
Mn			775 ppm	10.06 lb/h		39 ppm			39 ppm			39 ppm
Pb			56 ppm	0.48 lb/h		6 ppm			6 ppm			6 ppm
Li			182 ppm			182 ppm			182 ppm	43 lb/h solids		18 ppm
Inertia			22.1%			22.1%			22.1%			22.1%
H_2O		20 lb/h	777%			77.8%			77.0%			77.0%
Specific grey			1.132	1.303	1.86	1.13	1.109	1.315	1.13	1.434	1.86	1.13
Temp. °C	29	90	90	90	90	90	25	25	90	90	90	90
Temp. °F	85	195	195	195	195	195	77	77	195	195	195	195
Flow, gpm			15	0.11		15	0.22	0.05	15.3	0.15	0.1	15
Flow, gph			904	6.8	1.6	902	13.6	2.8	918	9.2	5.8	912
Flow, cfm	12.4	16.0										
Flow, lb/h			8540	74	24.8	8515	126	31	8672	110	78	8594
Specific heat Btu/lb °F			0.85			0.85	0.78	0.67	0.85		0.48	0.85
Heat Btu/h			1.41×10^6		2176	1.41×10^6	7568	16,000	1.44×10^6		7301	1.43×10^6
Density			9.45 lb/gal	10.9 lb/gal	15.5 lb/gal	9.44 lb/gal	9.24 lb/gal	10.9 lb/gal	9.45 lb/gal	12.0 lb/gal	15.5 lb/gal	9.43 lb/gal
NH_3		3.0 lb/h	352 ppm			35 ppm			35 ppm			35 ppm
	Air sparge to manganese reactor	Vent gases from manganese reactor incl. ammonia	Manganese slurry to thickener	Manganese thickener underflow at 20 wt% solids	Manganese filter cake	Manganese thickener overflow	$NaAlO_2$ solution 30 wt% $NaAlO_2$	$AlCl_3$ solution 40 wt% $AlCl_3$	Lithium aluminate slurry to thickener	Lithium aluminate thickener underflow at 39 wt% solids	Lithium aluminate centrifuge cake	Lithium aluminate thickener overflow

Table 5 of Maimoni shows a process flow sheet for various streams for Magmamax No. 1 brine.

Ex. 1004, 16–17 (reproduced at Pet. 40). Figure 5 of Maimoni is reproduced below.

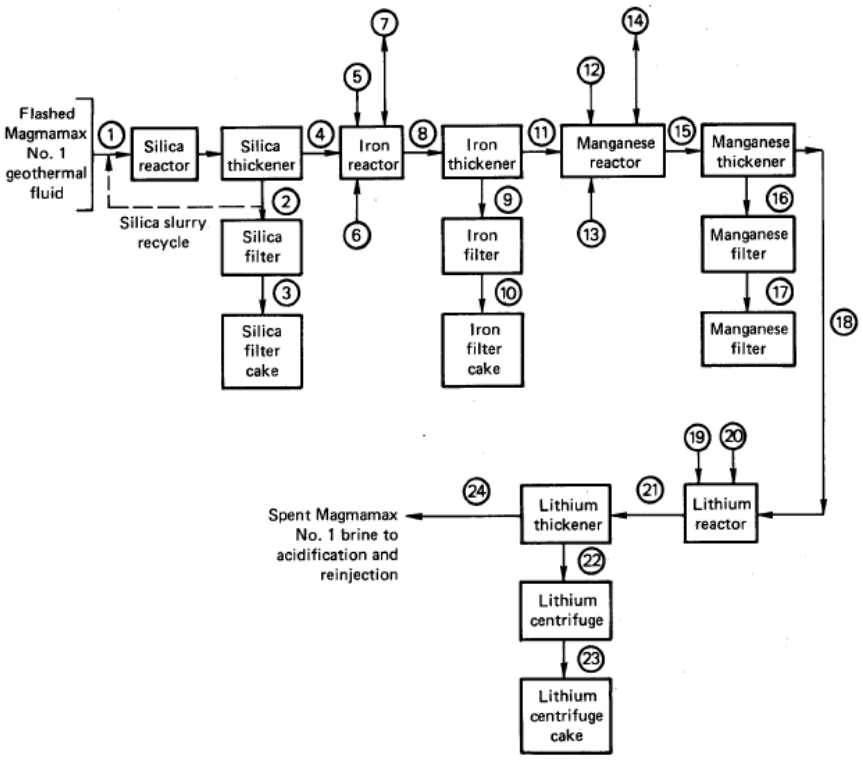

Figure 5. Process materials balance of Magmamax No. 1 brine (Hazen Research).

Fig. 5 of Maimoni shows a processing flow chart for Flashed Magmamax No. 1 brine.

Ex. 1004, 15 (reproduced at Pet. 39).

Patent Owner argues that the "22 ppm" value shown in Table 5 (for Stream No. 11) cannot be relied upon because:

- the streams shown in Table 5 refer to "nominal flows and compositions." PO Resp. 40–41 (citing Ex. 1004, 14);
- "Dr. Gallup agreed that Table 5 is not indicative of actual data." *Id*. at 41 (citing Ex. 2025, 160:13–15);
- "Maimoni reports that . . . the 'silica-separation step was not very effective, and silica was found to contaminate the products.'" *Id*. (quoting Ex. 1004, 14).
- the data recorded in Table 5 "appear to be calculated relative to the ***starting material*** concentrations rather than indicative of actual stream concentrations." *Id*. at 41–42 (citing Ex. 2002, ¶¶ 101-102); and,

- "[I]t is noteworthy that not a single component in Table 5 changes in concentration as the process progresses, despite components being fed to various process equipment." *Id*. at 42.

To buttress that last reason Patent Owner provides annotated versions of Figure 5 singling out the Manganese Reactor (*id*. at 43) and Table 5 focusing on the data for streams 11, 15, and 18 (*id*. at 44). Finally, Patent Owner lists what Patent Owner believes are "numerous other very clear errors with the data in Fig. 5." *Id*. at 45–46.

Given all this, Patent Owner concludes that a person of ordinary skill in the art would not have reasonably understood or inferred that the "22 ppm" value shown in Table 5 "accurately reflects" a brine. *Id*. at 46 (citing Ex. 2002, ¶¶ 104–105).

We disagree. Maimoni expressly describes a silica concentration of "22 ppm" in Table 5. A person of ordinary skill in the art reading Table 5 would understand it to accurately report "22 ppm" for silica for brine based on a "pilot plant test." Ex. 1004, 14, 16. While the value may be "nominal" in the sense that it does not reflect the result that might be obtained if an actual pilot plant was used, the data is nevertheless actual data from a "pilot plant test[]." *Id*.; Pet. Reply 18–19. The reasons Patent Owner gives speculate on the data that would be obtained were an actual pilot plant used to conduct the Hazen process. They do not, however, sufficiently establish that Maimoni does not describe, as a matter of fact, the actual result of a pilot plant test. As such, the "22 ppm" value shown in Table 5 (for Stream No. 11) can be relied upon to establish anticipation.

Accordingly, consistent with Petitioner's contention and the undisputed fact that 1 ppm = 1 mg/kg[2], Maimoni describes a brine with silica at "a concentration of silica ranging from 0 to 80 mg/kg" as specified in claims 1 and 15.

d. "a concentration of arsenic ranging from 0 to 7 mg/kg" (Claims 1 and 15)

Petitioner contends that Table 2 of Maimoni shows a brine having concentrations of arsenic of 0.2 ppm and 7 ppm which fall within the claimed range. Pet. 42 (citing Ex. 1004, 10 (Table 2)). Table 2 is reproduced below.

Table 2. "Typical" analysis for Magmamax No. 1 and Sinclair No. 4 brines.

	Magmamax 1	Sinclair 4
Total solids (g/l)	190	294
pH	5.6	5.2
Eh (vs NHE)	0.18	0.18
Composition (ppm by weight)		
SiO_2	200	506
NH_3	45	440
Li	117	245
K	8 500	14 300
Rb	56	25
Mg	75	68
Sr	366	600
Ba	290	–
Mn	565	1 260
Fe	422	1 300
Co	0.3	–
Mo	4	–
Cu	0.8	3
Zn	226	500
B	10	300
Sn	23	–
Pb	70	90
As	0.2	7
Sb	4	–
Bi	5	–
Se	6	2.5
Ag	0.5	0.5
Au	0.1	0.1
Pt	0.06	0.06

[2] Pet. 12; PO Resp. 7.

Table 2 of Maimoni shows analytical data for Magmamax No. 1 and Sinclair No. 4 brines.

Ex. 1004, 10.

Petitioner's reliance on Table 2 is problematic, because as Patent Owner points out, it discloses concentrations of silica and iron that fall outside the claimed ranges. PO Resp. 37.

Accordingly, Table 2 alone is insufficient to show that Maimoni anticipates the claimed composition, notwithstanding that it shows concentrations of arsenic within the claimed range.

Table 5 and Figure 5 are also insufficient to show that Maimoni anticipates the claimed composition because they do not mention arsenic. PO Resp. 40 (citing Ex. 1006, 16-17).

Thus there is no single description in Maimoni of a brine having all the claimed components with concentrations as claimed. To reconcile this for arsenic, Petitioner combines Table 2 with Table 5 and Figure 5. *See* Pet. 43 ("[t]he concentration of arsenic in Stream 18 of Figure 5 of Maimoni would be less than the initial arsenic concentration of 0.2 ppm set forth in Table 2 of Maimoni.").

Patent Owner argues that Table 2 and Table 5 cannot be combined. PO Resp. 37–39. We agree.

Patent Owner provides a chart showing a partial comparison of the brine of Table 2 and Stream No. 1 of Table 5. PO Resp. 39, citing Ex. 2002, ¶ 99; Ex. 1004, 10, 16. It is clear from the chart that the composition shown in Table 2 is very different from the composition reported in Stream No. 1 of Table 5. PO Resp. 39 (citing Ex. 2002, ¶ 99). Petitioner concedes as much. Pet. Reply 17; PO Sur–reply 16.

We observe that the section in the Petition discussing the arsenic limitation does not combine Table 2 with any particular stream in Table 5. Pet. 42. Other sections mention Stream No. 11 of Table 5. *E.g., id*. at 39. Be that as it may, the composition of Stream No. 11 is likewise very different from that shown in Table 2. Ex. 1004, 10, 16.

One of ordinary skill in the art would have had to resort to picking and choosing from the disparate disclosures of the brine compositions of Table 2 and Table 5 and, even then, it is not clear on this record that one of ordinary skill in the art would necessarily reach a composition as claimed.

Petitioner further contends that one of ordinary skill in the art would have recognized from Table 5 and Figure 5 that "arsenic will be 'co-deposited' with 'silica on the iron (III) hydroxide' as an inherent behavior of certain geothermal brine compositions." Pet. 42, relying on Ex. 1001, 19:1–6.

However, be that as it may, we have no way of knowing what the arsenic concentration would be, before or after co–depositing. There is no mention of arsenic in Table 5 or Figure 5. PO Resp. 40; Ex. 1004, 15–17. As Patent Owner points out, "arsenic concentration may actually ***increase*** in the process due to evaporation or by being fed into the process with certain reagents." *Id*. (citing Ex. 2002, ¶ 100).

Petitioner argues that "Dr. Harrison testified that Magmamax No. 1 brines include arsenic, which arsenic co-deposits and precipitates with iron and silica, along with barium, zinc, and lead, under appropriate air oxidation and pH modification conditions. (EX 1011, 114:6-118:7, 183:17-24, 298:5-22)." Pet. Reply 18. But that does not address the arsenic concentration. Even if arsenic co-deposits and precipitates with iron and silica, it must fall within the claimed range for Maimoni to anticipate the claimed composition.

In that regard, there is insufficient evidence that, after precipitation, the arsenic in the brine will necessarily have a concentration in the claimed range.

For the foregoing reasons, Petitioner has not shown that Maimoni describes a brine having arsenic in a concentration in the claimed range by a preponderance of the evidence.

e. "a concentration of iron ranging from 0 to 300mg/kg" (Claims 1 and 15)

We accept Petitioner's contention, which is not opposed by Patent Owner and is supported adequately by objective evidence, that Maimoni discloses a brine having iron at a concentration within the claimed range. Pet. 43 (citing *inter alia* Ex. 1004, 15, Table 5 (Stream No. 18)).

f. "recoverable amounts of one or more metals selected from the group consisting of lithium, manganese, rubidium, cesium and zinc or mixtures thereof." (Claims 1 and 15)

We accept Petitioner's contention, which is not opposed by Patent Owner and is supported adequately by objective evidence, that Maimoni discloses a brine with metals such as lithium and manganese in "recoverable amounts." Pet. 44 (citing Ex. 1004, 19).

g. Conclusion

Because Petitioner has not shown that Maimoni describes a brine having arsenic in a concentration in the claimed range by a preponderance of the evidence, Petitioner has not shown that Maimoni describes, expressly or inherently, the composition of claims 1 and 15.

2. Dependent Claims 2–14 and 16–18

Having found that Petitioner does not prove by a preponderance of the evidence that independent claim 1 or 15 are unpatentable based on

anticipation by Maimoni, we find that Petitioner has also failed to prove that any of the dependent claims are unpatentable on that same ground.

Patent Owner raises an additional reason why claims 12, 16, and 18 are not anticipated.

Patent Owner argues that Maimoni does not teach barium in a concentration within the ranges claimed in claims 12, 16 and 18. PO Resp. 46–48. Ex. 1001, 44:3 ("from 0 to 200 mg/kg" (claim 12); 44:19 ("from 0 to 200 mg/kg" (claim 16), 44:25–26 (less than about 200 mg/kg" (claim 18)).

Petitioner contends that "Maimoni discloses a barium concentration in brine samples produced by the Magmamax No. 1 well of between 54 ppm and 290 ppm (EX 1004, at 9, Table 1)." Pet. 48.

In that regard, Table 1 does show concentrations for barium (e.g., "54" ppm) that would appear to support Petitioner's contention.

However, Patent Owner points to this passage in Maimoni, which precedes Table 1:

> The chemical composition of the brines is so complex that systematic analytical errors can easily obtain. Thus the barium concentrations given in Table 1 were shown to be in error because of the precipitation of barium sulfate before sample analysis. A special sample was obtained and handled to minimize barium sulfate precipitation, and *a barium content of 290 ppm was measured vs the 80-125 ppm reported in Table 1*.

Ex. 1004, 7–9 (emphasis added). PO Resp. 48. This passage states that the barium content recorded in Table 1 should be "290 ppm," not what is actually recorded.

Petitioner does not dispute this.

Since "290 ppm" is outside the claimed range, we are not persuaded that Table 1 of Maimoni describes with sufficient clarity the claimed composition as Petitioner contends.

Petitioner argues that "a plain reading of that paragraph makes clear that the barium concentrations reported in Table 1 are actual barium concentrations, but that barium sulfate had already precipitated from the Magmamax No. 1 brine." Pet. Reply 21. We are unpersuaded by this argument.

Given that Maimoni recognizes an error in the data of Table 1 (*id*. at 7–9; PO Resp. 48; Ex. 1004, 9), one of ordinary skill in the art reading Table 1 would have questioned whether the data is in fact a correct record of barium's actual concentration in the brine. We agree with Patent Owner that "Petitioner's unsupported statements regarding a 'plain reading' of Maimoni … do not rebut this. (Reply, 20-21)." PO Sur–reply 20.

Also, to the extent Petitioner (Pet. 48) argues that the combination of Table 1 and Table 5 would yield a brine having barium at a concentration within the claimed range, we agree with Patent Owner that "there is no tie between the stream reported in Table 1 and those in Table 5." PO Resp. 47. As Patent Owner explains, "the brine composition in the first column of Table 1 is significantly different from the composition of feed stream 1 of Table 5." *Id*. (citing Ex. 1004, 9, 17; Ex. 2002, ¶ 108). One of ordinary skill in the art would not have looked to the composition of Table 1 as a natural candidate for "feed stream 1" in Table 5.

Accordingly, for this additional reason, Petitioner has not shown that Maimoni describes, expressly or inherently, the claimed compositions of claims 12, 16, and 18 by a preponderance of the evidence.

F. Obviousness – Maimoni and Brown

Petitioner challenges claims 1–18 as rendered obvious under 35 U.S.C. § 103(a) over Maimoni and Brown. Pet. 38–51.

1. Independent Claims 1 and 15

Petitioner argues that claims 1 and 15 are "rendered obvious over Maimoni (EX 1004) in view of Brown (EX 1005)." Pet. 38.

Petitioner does not explain how the combination of Maimoni and Brown overcomes the deficiencies in Maimoni identified earlier in addressing the anticipation ground; namely, that Maimoni does not describe a brine having arsenic in a concentration in the claimed range. For that reason, Petitioner has not shown that the combination of Maimoni and Brown renders obvious the composition of claims 1 and 15 by a preponderance of the evidence.

That being said, the only aspect of claims 1 and 15 that Petitioner directs our attention to is the limitation "a concentration of silica ranging from 0 to 80 mg/kg" (Claims 1 and 15). Pet. 41–42.

Petitioner argues that, "[e]ven if Maimoni is somehow interpreted to disclose a concentration range of silica that is *higher* than 80 mg/kg, it would have been obvious to a POSITA in view of the Brown to tune the process of Maimoni to reduce the silica concentration range to a level below 80 mg/kg to avoid silica scaling concerns . . . ." Pet. 41.

We are not placed in a position to do a meaningful review of this argument because Petitioner does not identify the disclosure in Maimoni that may "somehow [be] interpreted to disclose a concentration range of silica

that is *higher* than 80 mg/kg." and thus has not established the starting point of its obviousness argument. Pet. 41.

Petitioner has not shown that the combination of Maimoni and Brown renders obvious the composition of claims 1 and 15 by a preponderance of the evidence.

2. Dependent Claims 2–14 and 16–18

Having found that Petitioner does not prove by a preponderance of the evidence that independent claim 1 or 15 are unpatentable based on this obviousness ground, we find that Petitioner has also failed to prove that any of the dependent claims are unpatentable on that same ground.

G. Anticipation – Okada

Petitioner challenges claims 1–18 as anticipated under 35 U.S.C. § 102(b) by Okada. Pet. 51–64.

1. Independent Claims 1 and 15

a. "A treated geothermal brine composition" (Claims 1 and 15); "the composition comprising a treated geothermal brine" (Claim 1)

The parties agree that Okada discloses a "geothermal water." Pet. 52; PO Resp. 57. The question is whether Okada's "geothermal water" is a "geothermal brine" as the claims require.

Petitioner argues that "[t]he geothermal water referenced in Okada is a geothermal brine because it includes dissolved salts." Pet. 52 (citing Ex. 1003 ¶ 181).

Patent Owner argues that Okada does not mention salt. PO Resp. 59 ("the compositions provided in FIG. 2 do not include sodium content"); PO Sur–reply 24 ("As shown in Okada FIG. 2, the "geothermal water" is not fully characterized and only reports six elements. (EX1008, 9)."). Patent

Owner reproduces Figure 2 of Okada highlighting the data reported for "geothermal water," as follows:

Experiment Name	SiO_2 (mg/L)	Ca (mg/L)	Fe (mg/L)	As (mg/L)	P (mg/L)	Li (mg/L)
Deionized water	9.29	0.52	0.14	<0.01	<0.01	<0.01
Geothermal water	308	32.1	0.26	3.65	<0.01	1.42
Ex. example 1	14.5	8.54	0.03	0.48	2.42	0.97
Ex. example 2	175	21.6	0.17	1.64	2.54	1.07
Ex. example 3	94.4	32.4	0.13	0.05	0.71	1.05
Ex. example 4	255	24.0	0.10	1.37	3.16	0.83
Ex. example 5	111	35.3	0.04	0.031	2.81	0.84

Patent Owner's annotated version of Figure 2 of Okada showing experimental results and highlighting results for "Geothermal water".

PO Resp. 57; Ex. 1008, 9. According to Patent Owner, Okada's "geothermal water" "would at most be characterized as 'brackish water.'" *Id*. at 57–58. Patent Owner points out that the difference between a brine and brackish water is that the latter "has a lower salinity than a brine. (Ex. 2002, ¶130)." *Id*. at 58.

Petitioner counters that "Dr. Gallup [further] testified that Okada's 'geothermal brine [sic, water]' is equivalent to a 'geothermal brine' as defined by the '555 patent. (Ex. 2025, 252:10-254:18)." Pet. Reply 25.

We are not persuaded by Petitioner's arguments. One of ordinary skill in the art reading Okada would not know whether the disclosed "geothermal water" is a brine or brackish water since sodium is not mentioned. For the claimed "geothermal brine" to read on Okada's "geothermal water," the "geothermal water" must, at a minimum, be a "saline solution." This is so because the '555 patent defines a geothermal brine as "a saline solution that has circulated through the crustal rocks in areas of high heat flow and has become enriched in substances leached from those rocks." Ex. 1001, 7:8–11. Given no information about salt in Okada's

"geothermal water," it is difficult to ascertain whether Okada's "geothermal water" is a saline solution at all, let alone a "geothermal brine" as the Specification defines it.

Dr. Gallup initially testified that "Okada is a 'geothermal brine' because it includes dissolved salts." Ex. 1003, ¶ 181. Pet 52. But, even if true, we still do not know the level of salt in Okada's "geothermal water." Without that information, it impossible to know whether the brine is, by definition, a "saline solution" and "enriched in substances leached from those rocks." The possibility remains that Okada's "geothermal water" is brackish water rather a "geothermal brine." Dr. Gallup agrees. As Patent Owner notes:

> In responding to his own attorney's question on redirect examination, Dr. Gallup conceded that he could not tell if FIG. 2 of Okada was a geothermal brine or a brackish geothermal brine because of the limited amount of data:
>
> > A. I can't tell [what type of water it is] based on the limited amount of data that is there. ***I would need to know the sodium concentration to be able to tell whether I would classify it as a geothermal water or a geothermal brackish solution or a brine***.

PO Resp. 58–59 (quoting Ex. 2025, 339:6–10).

For the foregoing reasons, Petitioner has not shown that Okada describes a "geothermal brine" by a preponderance of the evidence.

b. "said geothermal brine is a Salton Sea brine" (Claim 15)

Petitioner concedes that "Okada does not specifically reference 'Salton Sea' brines." Pet. 55.

c. "having a concentration of silica ranging from 0 to 80 mg/kg" (Claims 1 and 15)

Petitioner contends that Okada discloses silica at a concentration within the claimed range. Pet. 52 (citing Ex. 1008, Figure 2 and ¶¶ 23–24).

Okada agrees with Petitioner's contention. Paragraph 24 of Okada recites "14.5 ppm" for silica and this falls within the claimed range. Ex. 1008, ¶ 24.

Accordingly, Petitioner's position that Okada describes "a concentration of silica ranging from 0 to 80 mg/kg" as specified in claims 1 and 15 is supported by a preponderance of the evidence.

d. "a concentration of arsenic ranging from 0 to 7 mg/kg" (Claims 1 and 15)

We accept Petitioner's contention, which is not opposed by Patent Owner and is supported adequately by objective evidence, that Okada discloses arsenic in a concentration of 0.48 ppm, which falls within the claimed range. Pet. 54; Ex. 1008, 24.

e. "a concentration of iron ranging from 0 to 300mg/kg" (Claims 1 and 15)

We accept Petitioner's contention, which is not opposed by Patent Owner and is supported adequately by objective evidence, that Okada discloses iron in a concentration within the claimed range. Pet. 54 (citing Ex. 1008, Figure 2).

f. "recoverable amounts of one or more metals selected from the group consisting of lithium, manganese, rubidium, cesium and zinc or mixtures thereof." (Claims 1 and 15)

Petitioner argues that Okada discloses reducing the lithium concentration of geothermal water from 1.42 mg/L to 0.97 mg/L and that the

latter value is a "recoverable amount" as the claims require. Pet. 56 (citing Ex. 1008, Figure 2).

The language of the claim is clear. The claim calls for a "recoverable amount" and no specific amount is recited. No express definition for "recoverable amount" is provided in the Specification that would alter that understanding. We need not address whether "recoverable amount" should be construed as "economically viable" because even if we gave it that construction the record insufficiently supports construing an "economically viable" amount as requiring a minimum amount.

Since Okada recovered 0.97 mg/L of lithium, Petitioner has shown that Okada describes "recoverable amounts" of lithium as specified in claims 1 and 15 by a preponderance of the evidence.

g. Conclusion

Because Petitioner has not shown that Okada describes a "geothermal brine" by a preponderance of the evidence, Petitioner has not shown that Okada describes, expressly or inherently, the composition of claims 1 and 15.

2. Dependent Claims 2–14 and 16–18

Having found that Petitioner does not prove by a preponderance of the evidence that independent claims 1 or 15 are unpatentable based on anticipation by Okada, we find that Petitioner has also failed to prove that any of the dependent claims are unpatentable on that same ground.

H. Obviousness – Okada and Brown

Petitioner challenges claims 1–18 as being rendered obvious under 35 U.S.C. § 103(a) over Okada and Brown. Pet. 51–64.

1. Independent Claims 1 and 15

Petitioner argues that claims 1 and 15 are "rendered obvious over Okada (EX 1006 [sic, 1008]) in view of Brown (EX 1005), Maimoni (EX 1004, or Christopher (EX 1006)." Pet. 51. (Maimoni and Christopher are not discussed. PO Resp. 62; *see generally* Pet. 51–64.)

Petitioner does not explain how the combination of Okada and Brown overcomes the deficiency in Okada identified earlier in addressing the anticipation ground; namely, that Okada describes a "geothermal water" rather than a "geothermal brine." For that reason, Petitioner has not shown that the combination of Okada and Brown renders obvious the composition of claims 1 and 15 by a preponderance of the evidence.

That being said, the only aspects of claims 1 and 15 that Petitioner discusses in the context of this obviousness ground are the limitations "a concentration of silica ranging from 0 to 80 mg/kg" (claims 1 and 15; Pet. 53); "said geothermal brine is a Salton Sea brine" (claim 15; Pet. 55); and the "recoverable amount" limitation (claims 1 and 15, Pet 56).

Regarding the silica limitation, Petitioner argues that, "[e]ven if Okada is somehow interpreted to disclose a concentration range of silica that is *higher* than 80 mg/kg, it would have been obvious to a POSITA in view of the Brown to reduce the silica concentration range to a level below 80 mg/kg to avoid silica scaling concerns . . . ." Pet. 53. Since we have determined that Okada discloses 14.5 ppm, which falls within the claimed range, this argument is moot.

Regarding the "Salton Sea" limitation of claim 15, Petitioner argues that it would have been obvious to a person of ordinary skill in the art to combine Okada with Brown to address a problem of silica fouling identified in Okada. Pet. 55. That Brown may address a problem of silica fouling that

Okada may experience does not adequately explain why one would employ a "Salton Sea brine" for the treated geothermal brine composition as the claim requires. For that reason, Petitioner has not shown that a composition comprising a Salton Sea brine would have been obvious over the combination of Okada and Brown by a preponderance of the evidence.

Regarding the "recoverable amount" limitation, we previously determined that Petitioner sufficiently shows that Okada describes "recoverable amounts" of, for example, lithium as specified in claims 1 and 15. Accordingly, it is unnecessary to address whether the combination of Okada and Brown would render that obvious.

Patent Owner argues that Petitioner's case for obviousness is deficient for another reason: that "Okada and Brown are directed to two completely different compositions. Okada discloses a geothermal water with low salt content (Ex. 1008, FIG. 2) whereas Brown is directed to extracting zinc from brines. (Ex. 1005, Title; Ex. 2002, ¶142)." PO Resp. 63. Furthermore, "Okada does not report zinc content. (Ex. 1008, FIG. 2)." *Id*. We accept Patent Owner's contention, which is not opposed by Petitioner and is supported adequately by objective evidence, that Okada is directed to a "geothermal water" and Brown involves a brine and these are different compositions. We have already established that the two are not the same.

For the foregoing reasons, including for the additional reason Patent Owner argues, Petitioner has not shown that the combination of Okada and Brown renders claims 1 and 15 obvious under § 103(a) by a preponderance of the evidence.

2. Dependent Claims 2–14 and 16–18

Having found that Petitioner does not prove by a preponderance of the evidence that independent claim 1 or 15 are unpatentable based on this obviousness ground, we find that Petitioner has also failed to prove that any of the dependent claims are unpatentable on that same ground.

III. CONCLUSION

For the foregoing reasons, Petitioner has not proven by a preponderance of the evidence that any challenged claim of the ’555 patent is unpatentable, as summarized in the following table:

Claims	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–18	102	Christopher		1–18
1–18	103	Christopher, Brown		1–18
1–18	102	Maimoni		1–18
1–18	103	Maimoni, Brown		1–18
1–18	102	Okada		1–18
1–18	103	Okada, Brown, Maimoni, Christopher		1–18
Overall Outcome				1–18

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has not shown by a preponderance of the evidence that claims 1–18 are unpatentable; and

FURTHER ORDERED that because this is a Final Written Decision, parties to this proceeding seeking judicial review of the Decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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