SHEFA GEMS®

Updated Competent Person's Report on the Shefa Gems® Ltd Gemstone Assets

Prepared for Shefa Gems Ltd

Competent Person:

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ABSTRACT

Shefa Gems® Ltd (**Shefa Yamim (A.T.M.) Ltd.[1])** is in an advance stage of an exploration programme with the intention of estimating a maiden Mineral Resource for its Kishon River Mid-Reach Project. Creo Design (Pty) Limited (Creo) was commissioned by Shefa Gems to compile an updated independent Competent Person's Report (CPR) on the Kishon Mid-Reach Project incorporating the drilling and bulk sampling programme results and the maiden Mineral Resource.

Shefa Gems®[2] Ltd is a company established in Israel for the purpose of prospecting and mining precious stones. The focus in particular is on the Gem Box mineral suite found in the Kishon Mid Reach that contains the rare natural moissanite, Carmel Sapphire ™ hibonite, sapphire, ruby, spinel, ilmenite, garnet and diamonds (rare), in addition to zircon and rutile. The Kishon River catchment area at Haifa, Israel, is some 85km north of Tel Aviv. Over the past few years, and as a direct result of Shefa Gems' extensive exploration, northern Israel has become known for its high-quality rubies and sapphires, large natural moissanite crystals, Carmel Sapphire™, hibonite as well as diamonds. The precious stones occur mainly in primary deposits within the Cretaceous volcanic host rocks on Mount Carmel, with some in Mio-Pliocene volcanic host rocks bordering the Yizre'el Valley and all types in secondary deposits in valley-fill sediments in the Mid-Reach of the Kishon River valley flanking Mt. Carmel along its north-eastern side.

Therefore, the principal exploration targets of Shefa Gems are primary sources on Mt. Carmel (Mesozoic mafic and ultra-mafic volcanic rocks) and secondary sources of valley-fill sediment deposits throughout the Kishon River catchment (sourced in Cenozoic mafic volcanic rocks). Following 19 years of exploration Shefa Gems has reached a stage whereby it delineated approximately 4.5km long exploration target of some 5 million tonnes of gemstone bearing gravel.

Shefa Gems has established its Target Mineral Assemblage (TMA), which constitutes two significant mineral suites:

- The Gem Box suite: Diamond (rare), natural moissanite, and the corundum gem varieties of sapphire, Carmel Sapphire ™, ruby, Hibonite, ilmenite, garnet and spinel.
- The HIM suite of Heavy (H) industrial (I) minerals (M): zircon, and rutile.

The rare presence of diamonds, along with an abundance of the two other high pressure minerals, natural moissanite and corundum (including sapphire, Carmel Sapphire™, ruby and hibonite), in several primary Mesozoic sources on Mt. Carmel and in the Cenozoic Kishon Valley secondary deposits, points to an unusual, off-craton geological history that warrants special attention. Likewise, the presence of corundum in both Mesozoic mafic and ultra-mafic volcanics and younger Cenozoic mafic volcanics supports the potential for sapphire-dominant (and to a lesser extent, ruby) placers to

[1] Changed the company name to Shefa Gems Ltd from June 14, 2019.

[2] Shefa Gems applied to register the trademark at the UK Intellectual Property Office following the change of the Company's name to Shefa Gems Ltd., as announced on 14 June 2019.

have been developed along the Kishon Valley, especially in the Mid-Reach zone between the Yizre'el and Zevulun Valleys. Incorporating the available geological mapping, a robust, and dynamic geological model was developed in February 2014 to guide placer exploration in the Kishon catchment. Since the previous CPR at the end of 2017, Shefa Gems completed bulk sampling planned for Zone 1 with a shift towards the recovery of the Carmel Sapphire ™ and spinel as the dominant gem minerals in for the most part of Zone 1.

Following a review by Macquarie University, led by Professor Griffin and Shefa Gems, the Company has confirmed the presence of hibonite in some of its alluvial bulk samples and in the Rakefet Magmatic Complex (RMC). Shefa Gems has discovered examples intergrown with grossite, fluorite, spinel and native vanadium of varying quality and size.

After completing the sampling and processing of 14 alluvial bulk samples in Zone 1 a total of 9,778.15 carats of TMA was recovered from 6,385 tonnes of gravel sampled. The DMCH Suite was renamed to Gem Box suite. Spinel, garnet and ilmenite greater than or equal to 1mm was re-assigned to the Gem Box suite following the recovery of good quality 3,952.91cts, 2,175.77cts and 768.86cts respectively. The revised TMA, dominated by the Gem Box suite, is comprised mainly of minerals that are ≤0.65 cts/stn (85%) with 15% being ≥0.65cts. The largest gems recovered were: Carmel Sapphire ™ 33.3ct, garnet 13.6ct, sapphire 5.7ct, spinel 6.2ct, hibonite 2.8ct and ruby 1.7ct. The overall TMA grade was some 153 cpht (at a bottom screen size of 1 mm), with the grade dominated by 4 Gem Box suite minerals: spinel (69.91 cpht); Carmel Sapphire ™ (39.36 cpht); garnet (34.09 cpht) and ilmenite (12.06 cpht).

By end of August 2019 bulk sampling at Zone 2 yielded a total of 6,853 cts of gemstones from 3,839.58 tonnes of basal gravels with an overall TMA recovered grade of 178.50 cpht at a bottom screen size of 1mm. Of this, the Gem Box suite comprised 99% of the TMA, with the heavy industrial minerals ("HIM") suite of zircon and rutile accounting for the remaining 1%. Samples were dominated by gemstones (99%) with spinel accounting for 55% of the Target Mineral Assemblage ("TMA") followed by garnet 20%, ilmenite 16%, sapphire 4.5%, Carmel Sapphire™ 3% and the remaining 0.16% shared between hibonite, Natural Moissanite™ and ruby. By June 2019, a total of 30 bulk and mini bulk samples had been collected from the Kishon Mid-Reach Zone 2 from some 6,094 tonnes of gravel. The volume estimations reported in the CPR of December 2017 were revised following the completion of the drilling and bulk sampling campaigns in Zone 1, together with the recent exploration advances in Zone 2 and the reconnaissance work at Zone 3. Estimates of the areas and tonnages for all three exploration target Zones were derived from additional field mapping, drilling and bulk sampling in Zones 1 to 3, including the successful awarding of Prospecting Licence 869C9 that covers Zone 1 within the larger Exploration Permit 869B11.

Kishon Mid-Reach alluvial placer geological (exploration) target and partial resource volumes.

Zone	Area (m^2)	Overburden Ton (t)	Placer (Basal) Gravel Ton (t)
Zone 1	250 000	1 930 000	1 120 000
Zone 2	269 000	1 698 000	873 000
Zone 3	788 000	6 621 000	2 979 000
Total Mid-Reach	1 308 000	10 250 000	4 980 000

The total estimated geological (exploration) target and partial resource for the three Zones is almost 5 million tonnes (Mt) of gemstone bearing (basal) gravels overlain by approximately 10 Mt of overburden in the Kishon Mid-Reach alluvial placer.

The valley-fill sediments accumulated as Kishon River floodplain and terrace deposits generally comprise a basal gravel layer of 2 - 4m thick overlain by a 3 - 6m thick dark-brown clay overburden. The gravel unit comprises cobble to pebble, rounded to sub-rounded, clast-supported gravel in a sandy clay matrix with occasional boulders. A total of some 9,294 tonnes of basal gravels have been analysed by the Shefa Gems' in-house processing facility and laboratories at Akko for TMA Suite minerals, including the Gem Box suite and the HIM suite. All the samples treated yielded Kimberlitic Indicator Minerals (KIMs,) and the TMA, of which >95% are from the Gem Box suite.

Zone 1 and 2 in the Kishon Mid-Reach valley was classified as a **Mineral Resource** based on the occurrence of gemstones of economic interest in such form, quality and quantity that there are reasonable and realistic prospects of gemstone extraction for the general consumption in the jewellery market. Sample location, quantity, grade, continuity and other geological characteristics of this mineral resource is known, estimated from specific geological evidence and knowledge. The sample coverage could demonstrate grade continuity with a high degree of certainty and was therefore classified as an **Inferred Resource**. Zone 3 is not to be included yet in the Mineral Resources of Shefa Gems, instead it considered a "Geological (Exploration) Target" for which tonnage, densities, shape, physical characteristics, grade and mineral content cannot be estimated with a reasonable level of confidence at this stage. The statement in the table below presents the total estimated resources and reserves for the Kishon Mid-Reach in-situ deposits.

Mineral Resource and Mineral Reserve statement for the Kishon Mid-Reach Zone 1 & 2 deposits at a zero cut-off grade (27 September 2019).

Mineral Reserve Category				Mineral Resource Category			
Classification	**Zone**	**Tonnage (t)**	**Grade ct/100t**	**Classification**	**Zone**	**Tonnage (t)**	**Grade ct/100t**
Total Probable		**0**		**Inferred**	**1**	**1 120 000**	**152.44**
		0		**Inferred**	**2**	**873 000**	**175.85**
Total Reserves				**Total Inferred**		**1 993 000**	**162.69**

The overall Gem Box Suite has a contained rough revenue of US$41/t, dominated by the Carmel Sapphire™ at about US$35/t because of its high intrinsic value (including large stones) and comparatively good grades. Shefa Gems is about to embark on a trial mining campaign and to this end it has recently completed a Technical Economic Evaluation and is in an advance stage of planning and development of its trial mining phase.

1. Introduction

Shefa Gems® Limited (Shefa Gems) has completed a considerable portion of the exploration programme with the intention of estimating a Mineral Resource for the Kishon River Mid-Reach alluvial deposits. Creo Design (Pty) Limited (Creo) was commissioned by Shefa Gems to compile an updated independent Competent Person's Report (CPR) on the Kishon River Mid-Reach alluvial deposits incorporating the latest bulk sampling programme results and the Mineral Resource estimation. Shefa Gems' primary business objective is the exploration, evaluation and development of its gemstone prospect situated within the Kishon River Valley, Haifa, northern Israel. Shefa Gems has been listed on the London Stock Exchange (LSE) since December 2017.

This CPR on the Kishon River Mid-Reach alluvial deposits has been compiled as part of the supporting technical documentation for the estimation of the Mineral Resource for the Kishon River Mid-Reach alluvial deposits, which will be considered by the LSE as a material change to the Shefa Gems Project. This CPR is a full evaluation of the exploration programme current status and the resulting Mineral Resource estimation. This CPR has been prepared in accordance with the "South African Code for Reporting of Exploration Results, Mineral Resources and Mineral Reserves" (SAMREC Code), as amended 2016. The guidelines as set out in the SAMREC Code are considered by Shefa Gems to be a concise recognition of the best practice reporting methods for this type of mineral development, and accord with the principles of open and transparent disclosure that are embodied in internationally accepted Codes for Corporate Governance.

Shefa Gems is engaged in the exploration for precious stones deposits and in particular diamonds, moissanite, sapphire and ruby in the Kishon River catchment area, Haifa, Israel, some 85km north of Tel Aviv. The company maintains offices and staff in Netanya (Head office) and Akko (operational Centre and Laboratories), Northern Israel. The effective date of this report is 5 November 2019 and this report has been compiled based on information available up to and including 31 August 2019. This report describes the exploration developments and results of a mineral resource estimation based on drilling and bulk sampling as part of an extensive exploration campaign. In accordance with the Listings Requirements and the contents of the SAMREC Code, this CPR has been prepared under the direction of the Competent Person (CP) who assumes overall professional responsibility for the document. The CPR however is issued by Creo, the commissioned entity, and accordingly Creo assumes responsibility for the views expressed herein.

1.1 Scope of Opinion

Creo has undertaken an independent technical review of the Kishon Mid-Reach Project for Shefa Gems, in order to identify the factors of a technical nature that would influence the future of the Kishon Mid-Reach Project. Creo has reviewed all available technical information, particularly in terms of exploration findings and feasibility parameters, where available, for the Kishon Mid-Reach Project. This technical information has been used as the basis of this CPR. Creo has also investigated

background information to satisfy itself that all technical factors that are likely to impact the asset have been considered.

Creo considered the strategic merits of the Kishon Mid-Reach Project based upon its significance as a placer deposit located in a major drainage course draining a large complex of volcanic bodies, the substrate rock on Mount Carmel, the Zevulun and Yizre'el valleys and their margins - Menashe Hills, Tivon-Alonim Hills, and Nazareth range. This CPR has been compiled in order to incorporate currently available information that will enable potential investors to make a reasoned and balanced judgement regarding the potential of Kishon Mid-Reach.

No warranty or guarantee, be it express or implied, is made by the author with respect to the accuracy of the legal aspects of this document. There is no legal uncertainty on the ownership of the Shefa Gems Project and the legal ownership and all mineral rights have been verified.

1.2 Competent Persons Declaration

Johan Hattingh, employed by Creo as a geologist with more than 30 years of experience, is the author responsible for the preparation of this report. Johan Hattingh is Competent Persons (CP's), as defined by the SAMREC Code. The Competent Person considers the SAMREC Code to be the most appropriate standard for the Public Reporting of Exploration Results, Mineral Resources and Ore Reserves. The SAMREC Code sets out minimum standards, recommendations, and guidelines for Public Reporting.

1.3 Statement of Independence

Creo is independent of the company, its directors, senior management and its other advisers; has no economic or beneficial interest (present or contingent) in the company or in any of the mineral assets being evaluated and is not remunerated by way of a fee that is linked to the admission or value of the issuer.

1.4 Personal Inspections

Johan Hattingh, in his capacity as CP, conducted an inspection visit during early November 2015 when the exploration sites, processing facilities and laboratory were visited. During this visit, discussions were held with key on-site and head office personnel. The technical information used in this CPR was provided by Shefa Gems and used in good faith by Creo. Where possible, Creo have satisfied itself that such information is both appropriate and valid to ensure SAMREC compliance in terms of the level of disclosure.

1.5 Reliance on Other Experts and Sources of Information

The CP of this Technical Report states that Dr. J. Hattingh is a competent person for the areas as identified in the appropriate "Certificate of Competent Person" attached to this report. Johan Hattingh has followed standard professional procedures in preparing the content of this report. Data used in this report have been verified where possible, and this report is based on information

believed to be accurate at the time of its completion. The author has relied to a large extent on reports provided by Shefa Gems and the work done by external experts appointed by Shefa Gems.

The technical information supplied to Creo are considered both valid and accurate for compiling this CPR. In terms of all legal aspects relating to the Shefa Gems properties, Creo has placed reliance on the management of Shefa Gems that the permit validity, status of permit registration, fees payable, and agreements with landowners are correct. The legal statements referred to the above are based on information provided by the management of Shefa Gems and are true and correct to the best knowledge of Creo.

2. Corporate Structure

Shefa Gems, an Israel based company, listed on the London Stock Exchange as Shefa Yamim (A.T.M.) Ltd on 18 December 2017. Shefa Yamim (A.T.M.) Ltd. was established in 1999 and was held by a holding company, Shefa Yamim Ltd until December 2017. As a result of the Company issuing shares on the London Stock Exchange on December 18, 2017, the percentage owned by the holding company was reduced. The holding company is a public company whose securities are registered for trade on the Tel Aviv Stock Exchange.

On 11 April 2019, the Company announced its intention to change the English name of the Company to Shefa Gems® Limited. Shefa Yamim announced on 14 June 2019 that the Israeli Companies Registrar has given effect to the change of name to Shefa Gems Ltd. The Company's TIDM, SEFA, and the Company's registered number, 51-272621-7, remained unchanged.

It is intended that the structure be further changed in the near future as a result of proposals now being implemented to distribute the shares now owned by Shefa Yamim Ltd. directly to its own shareholders. These proposals are subject to Court sanction in Israel.

3. Project Description and Location

The Shefa Gems property is located across the Kishon catchment in northern Israel. It includes the Zevulun and Yizre'el Valleys, as well as the adjacent elevated terrains of Mt. Carmel (including ten volcanic complexes), Nazareth range, Ramot Menashe and Tiv'on hills (Figure 1).

4. Topography and Climate

The permit areas include a variation of landscape types, which are briefly described below. Mt. Carmel occurs in the southern part of the permit area with a general northwest-southeast trend between Nahal Yoqne’am (Nahal is a stream or ephemeral stream valley) and the Mediterranean Sea. The highest points along Mt. Carmel are some 500m above mean sea level (amsl), with a maximum of 546m at Rom Ha-Carmel. The Mt. Carmel ridge is asymmetric with slopes descending steeply to the northwest and northeast and gently toward the southwest and southeast (Figures 1 and 2).

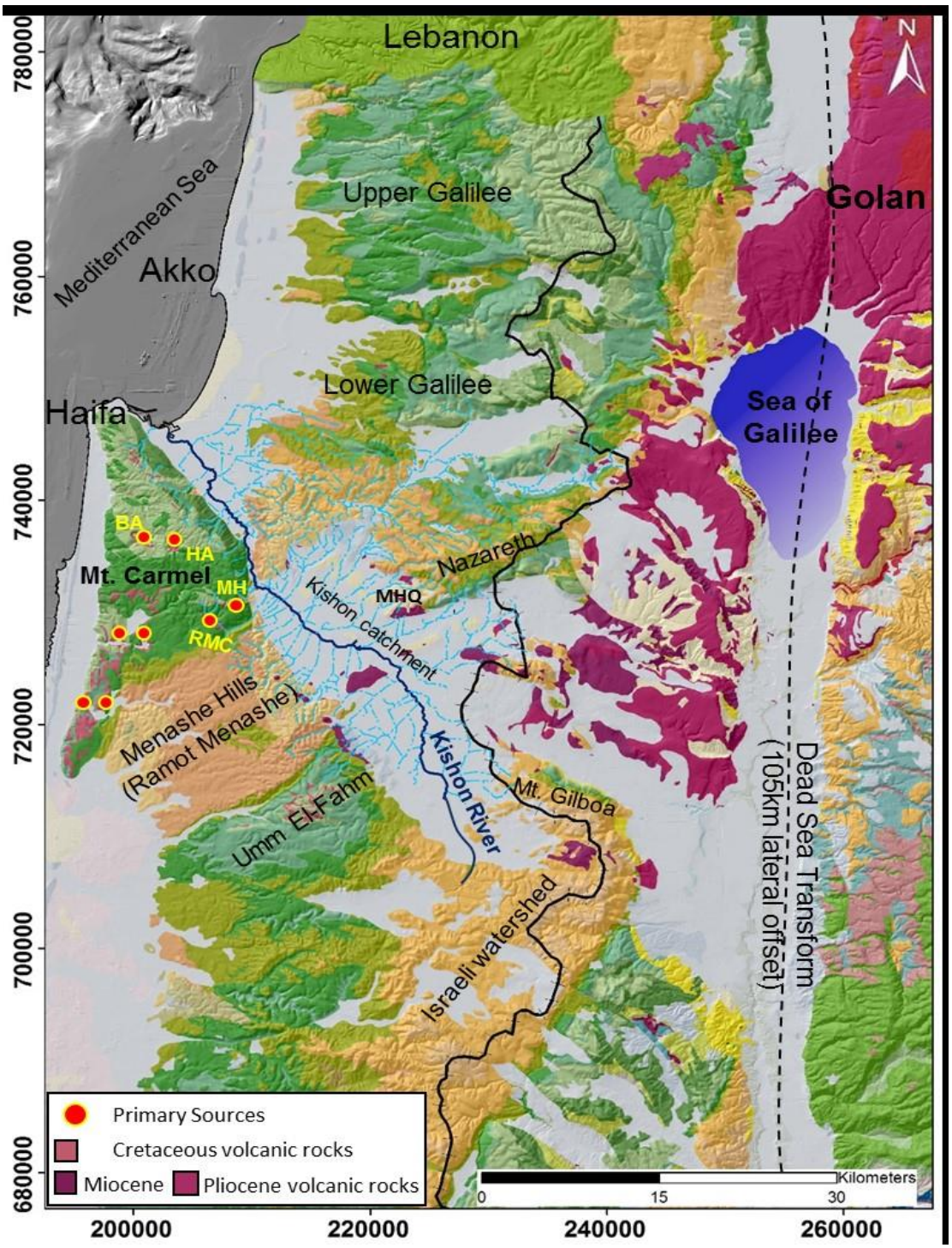


Figure 1: Locality map showing the volcanic bodies inside Exploration permit 869B11: RMC-Rakefet Magmatic (volcanic) Complex; MH-Muhraka; BO-Beit Oren; HA-Har Alon, in addition to the other volcanic bodies inside prospecting permit Carmel.

Southeast of Mt. Carmel is Ramat Menashe (Menashe Hills), which covers the area between Nahal Yiron to the southeast and Nahal Yoqne'am to the northwest. The average elevation of Ramat Menashe is 250m amsl, with two peaks reaching some 400m. Here the landscape is characterised by gentle, rounded hills. To the northeast, Ramat Menashe rises steeply above the Yizre'el Valley as a result of a recently active geological fault, whereas to the southwest, the slopes are gentle.

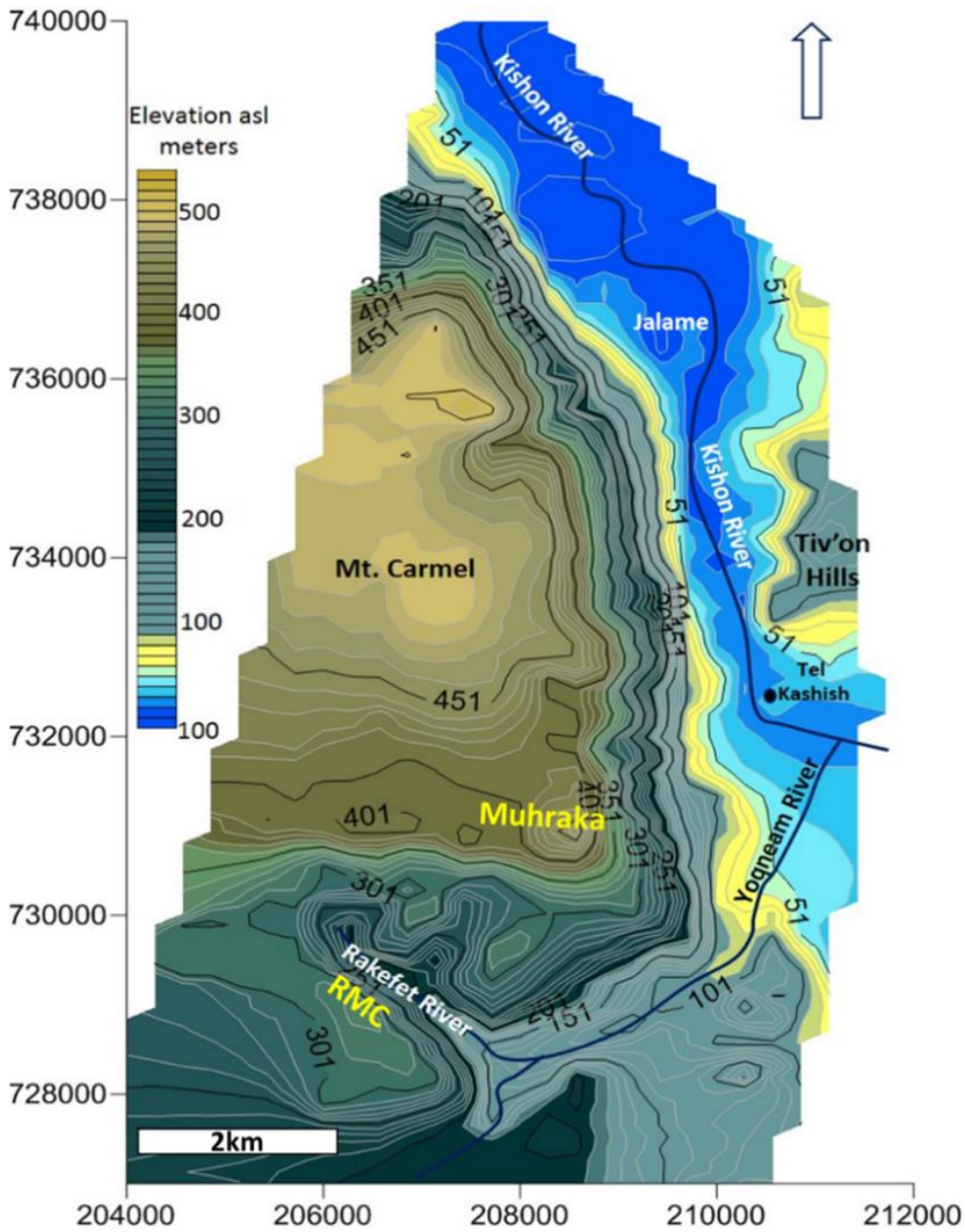


Figure 2: Topographic model of Mt. Carmel summit and north-eastern slopes as well as Tel Kashish and the Kishon River Mid and Distal Reach.

Southeast of Ramat Menashe, in the southwest part of the license area, is the Umm-el-Fahem range which lies between the Dotan Valley to the southeast, and the Yiron Valley to the northwest. These mountains reach a topographic high of 527m at Mt. Alexander above the village of Um-el-Fahem.

Northeast of Mt. Carmel is a flat area called Emeq Zevulun, which is adjacent to the Lower Galilee Mountains to the east and the Mediterranean Sea to the west. The Zippori River drains the Nazareth range into the distal reach of the Kishon River.

The permit area is drained by the Kishon River, and its floodplain represents an important part of the exploration area. The Kishon River, 77km long, flows through the Yizre'el Valley into the Zevulun Valley where it enters the Mediterranean Sea in the Bay of Haifa. Some 40km lies within the permit area. The river drains an area of some 1 122km^2 in total. Its headwater reach is in the north-western

part of Mt. Gilboa east of the permit area, and it flows in a west-north-westerly direction through the Yizre'el Valley, emptying into the Haifa Bay in the Mediterranean Sea.

The climate of the area is generally of the Mediterranean subtropical type, with rainfall restricted mainly to the winter months. In January temperatures average 14°C. In July the average temperature is 27°C. Rainfall is about 1 015mm annually (Galilee). Very well-developed vegetation in the area is represented by bush and small trees.

5. Legal Aspects and Tenure

5.1. Ownership

Ownership of surface rights for land covered by Shefa Gems' Exploration and Prospecting Permits/license is predominantly held by the State of Israel. Small pockets of land in the north-eastern extreme of the prospecting permit are held by private landowners.

5.2. Surface Rights

Mineral rights belong to the State of Israel and since February 1999, Shefa Gems has been granted authorities. The Inspector of Mines at the Ministry of National Infrastructure issues these permits for a maximum period of 24 months. Tables 1, 2 and 3 list the permits/licences issued to date (Figure 3).

Table 1: List of Prospecting License – Kishon Mid-Reach Zone 1

Permit #	Prospecting License No.	Issue date	Expiry date	Surface area (Dunam)*	Hectare
1	Prospecting License No. 869C9	06/06/2018	05/06/2019	252	25.2
2	Prospecting License No. 869C10	06/06/2019	05/06/2020	252	25.2

*1 dunam = 0.1ha = 0.001km²

Table 2: List of Exploration permits

Permit #	Exploration permit No.	Issue date	Expiry date	Surface area (Dunam)*	Hectare
1	Exploration permit No. 24	15/04/1999	14/04/2000	10 740	1 074
2	Exploration permit No. 39	01/08/1999	04/04/2000	69 000	6 900
3	Exploration permit No. 35	15/04/2000	14/04/2001	69 000	6 900
4	Exploration permit No. 40	15/04/2001	14/07/2002	112 000	11 200
5	Exploration permit No. 47	16/07/2002	31/12/2003	112 000	11 200
6	Exploration permit No. 74	01/01/2004	31/08/2005	112 000	11 200
7	Exploration permit No. 98	01/01/2006	31/05/2007	145 740	14 574
8	Exploration permit No. 134	01/08/2007	31/03/2009	173 887.5	17 389
9	Exploration permit No. 169	01/04/2009	31/03/2011	173 887.5	17 389
10	Exploration permit No. 206	15/05/2011	14/05/2013	173 887.5	17 389
11	Exploration permit No 869B4	20/10/2013	19/10/2014	173 887.5	17 389
12	Exploration permit No. 869B5	30/12/2014	29/12/2015	173 888	17 389
13	Exploration permit No. 869B6	06/04/2016	05/04/2017	173 888	17 389
14	Exploration permit No. 869B7	06/04/2017	05/06/2018	173 888	17 389
15	Exploration permit No. 869B8	06/06/2018	05/06/2019	173 636	17 364
16	Exploration permit No. 869B11	06/05/2019	05/05/2020	173 636	17 364

Table 3: List of Prospecting Permits

Permit #	Prospecting permit No	Issue date	Expiry date	Surface Area (Dunam)	Hectare
1	Prospecting Permit No. 23	15/02/1999	17/04/1999	10 740	1 074
2	Prospecting permit No. 48	1/08/2002	31/12/2002	1 046 552	104 655
3	Prospecting permit No. 54	01/01/2003	20/07/2003	1 046 552	104 655
4	Prospecting permit No. 57	01/06/2006	31/12/2003	822 280	82 228
5	Prospecting permit No. 58	01/01/2004	31/08/2004	844 575	84 458
6	Prospecting permit No. 81	01/01/2005	31/08/2005	1 085 000	108 500
7	Prospecting permit No. 111	01/12/2006	30/11/2007	455 000	45 500
8	Prospecting permit No. 139	01/01/2008	31/12/2008	598 962	59 896
9	Prospecting permit No. 140	01/01/2009	31/12/2009	598 962.5	59 896
10	Prospecting permit No. 182	01/01/2010	31/12/2011	327 551.1	32 755
11	Prospecting permit No. 183	01/01/2010	31/12/2011	158 012	15 801
12	Prospecting permit No. 221	01/04/2012	31/03/2014	327 551.1	32 755
13	Prospecting permit No. 222	01/04/2012	31/03/2014	158 012	15 801
14	Prospecting permit No. 837A8	15/07/2014	14/07/2015	327 551	32 755
15	Prospecting permit No. 899A3	15/07/2014	14/07/2015	112 904	11 290
16	Prospecting permit No. 837A9	21/12/2015	20/12/2016	327 551	32 755
17	Prospecting permit No. 899A4	21/12/2015	20/12/2016	112 904	11 290
18	Prospecting permit No. 837A10	21/12/2016	20/12/2017	327 551	32 755
19	Prospecting permit No. 899A5	21/12/2016	20/12/2017	112 904	11 290
20	Prospecting permit No. 837A11 – Carmel	21/12/2017	20/12/2018	327 551	32 755
21	Prospecting permit No. 899A6 - Ramot Menashe	21/12/2017	20/12/2018	112 904	11 290
22	Prospecting permit No. 837A12 – Carmel	21/12/2018	20/12/2019	327 551	32 755
23	Prospecting permit No. 899A7 - Ramot Menashe	21/12/2018	20/12/2019	112 904	11 290

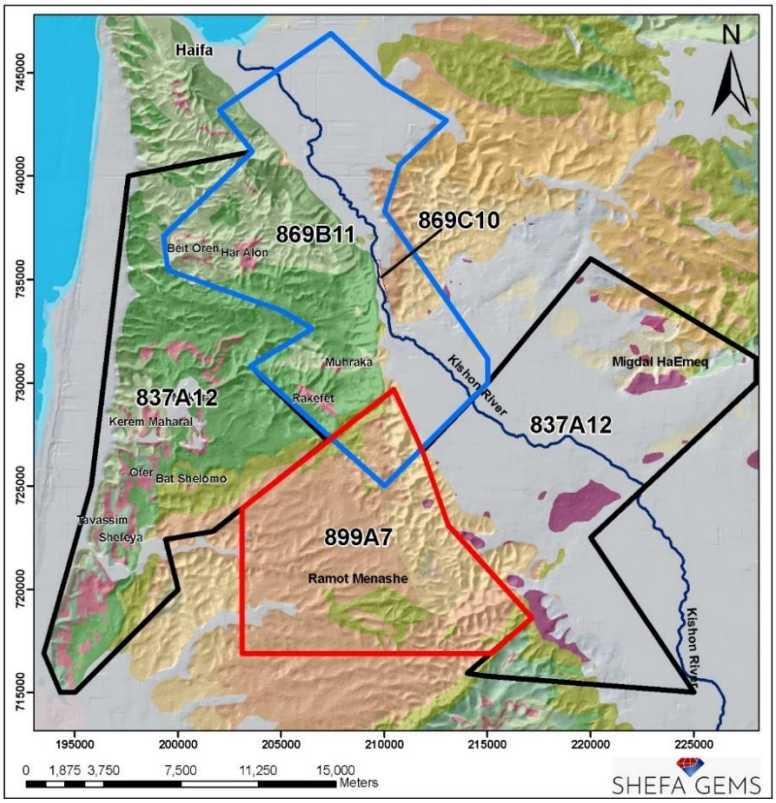


Figure 3: Location map showing the current permits of Shefa Gems, covering an area of 614km^2.

Shefa Gems currently holds the rights for exclusive exploration and prospecting permits covering a total area of some 614 000 dunam (614km^2).
This area is divided into three permits (Figure 3) namely:

- Exploration permit 869B11

Placer targets: Kishon River – Kishon Mid-Reach & Zevulun and Yizreel valleys.
Volcanic targets: Rakefet, Muhraka, Har Alon and Beit Oren on Mt. Carmel.
Permit area: 173 636 dunam (173.636km^2)

- Prospecting permit 837A12

Volcanic targets: Makura, Tavassim, Ofer, Shefeya, Bat Shelomo, Kerem Maharal, Migdal Ha-Emeq (valleys margins)
Permit area: 327,551 dunams (327.551km^2)

- Prospecting permit 899A7

Volcanic targets: Ramot Menashe area
Permit area: 112 904 dunams (112.904km^2)

5.3. Royalties

State royalties of 5% for precious stones is payable as per the State of Israel Ministry of Mining fiscal regime for mining.

5.4. Environmental Compliance Status

Due to its limited land surface, semi-arid climate, high population growth and resource scarcity, Israel is highly susceptible to environmental challenges. These include water shortages and pollution, waste production and disposal, air pollution and population density. As a result, resource development, in particular water, has benefited from relatively high government support throughout most of the country's history. For this reason, Israel's water conservation and reclamation infrastructure is one of the most advanced in the world, with approximately half its water supply derived from reclaimed and treated waste water, brackish water and desalinated water. Additionally, Israel is party to several international agreements regarding air pollution and climate change.

Environmental compliance is a high priority for Shefa Gems and continuous awareness programmes are followed through staff training and implementation of strict company policy in terms of environmental issues such as land use, water and air quality adherence. The company has demonstrated its devotion to environmental compliance during the past 20 years of exploration by enjoying a very good relationship with the relevant authorities.

5.5. Other Legal Issues

Creo's CP has reviewed the mineral tenure related to the Shefa Gems Permits and has independently verified the legal status and ownership of the Shefa Gems Permits.

Regarding the status of the current permits, Creo's CP has independently verified the information,

opinions and data supplied by Shefa Gems representatives and by independent experts retained by Shefa Gems as far as possible.

6. Infrastructure

The Shefa Gems permit area is near the Haifa industrial area where a full-service community exists that can easily provide essential services 12 months a year. Haifa has a qualified work force and equipment can be readily provided. Among many of the businesses and support services, Haifa also has excellent medical care facilities, road networks, electricity supply, seaports and an airport.

The prospecting area has a well-developed transportation network, which includes ports, highways, good roads, and a modern railway system. Haifa Port and a fishing port are located about 10km to the northwest of the permit area. The ports are connected with the central and northern parts of Israel through the Haifa – Tel Aviv and Haifa-Yoqne'am highways. District roads connect numerous small settlements and most of them are paved.

Construction on the Valley-Railway (Rakevet Ha-Emeq) to link Tiberias-Beit Shean in the Jordan Valley and the Haifa Port has recently been completed, in addition to the new Road 6 (Toll road). Shefa Gems' operational facility is located approximately 15km north of the Haifa port.

7. Geological Setting

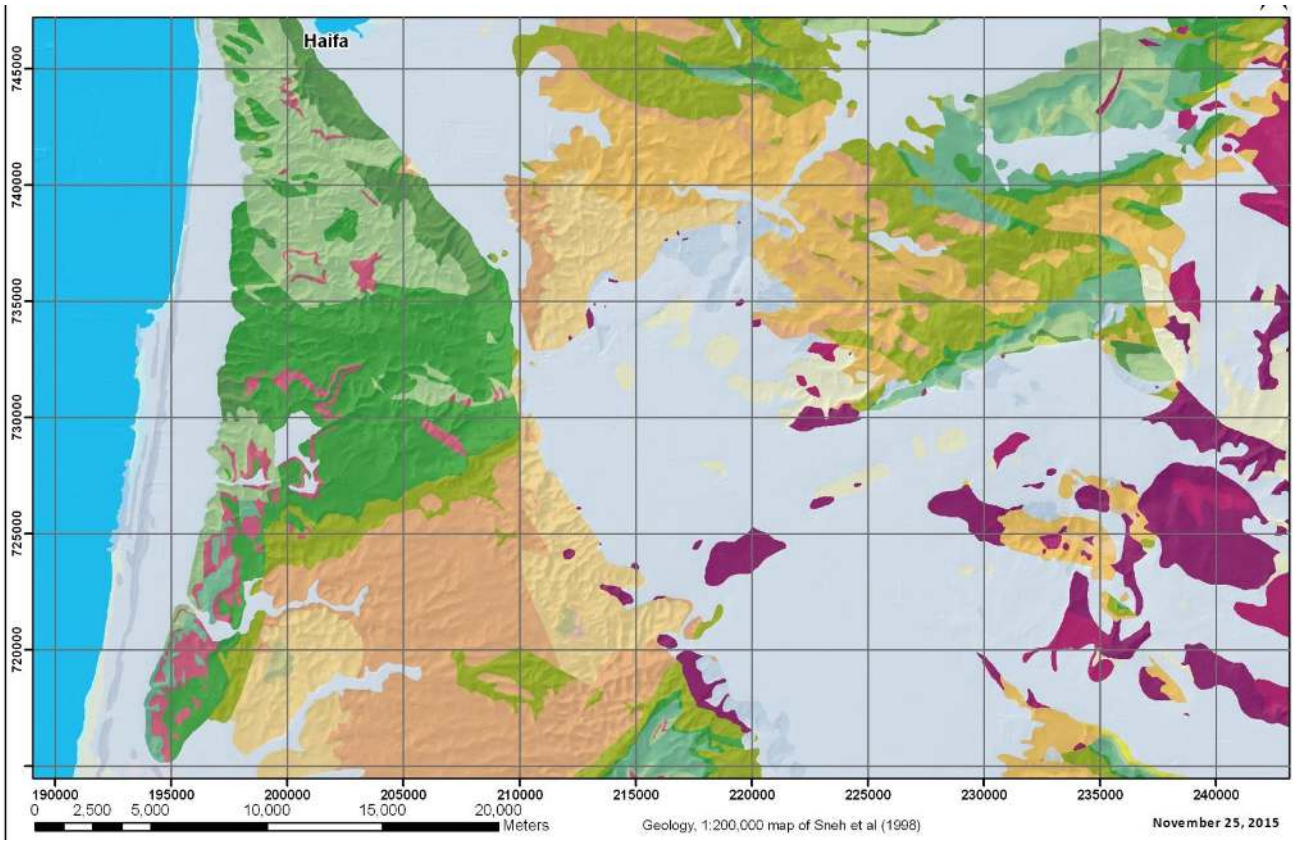
7.1. Regional Geology

Mt Carmel and surroundings are predominantly underlain by carbonates, as part of the Cretaceous Judea Group. Significant facies changes over short distances reflect the unique development history of the Mt Carmel area close to the edge of the Jurassic to Cretaceous carbonate platform, and the variety of depositional environments that characterize this transition zone. Cenomanian volcanic horizons occurring as pyroclastics, with minor lava flows, erupted in a number of well-defined and radiometrically dated events occur as interbedded within the carbonates.

This area is situated on the Arabian Plate flanking a recently active rift-zone rendering it atypical as a potential high-pressure mineral producing area. The carbonate platform experienced equilibrium tectonic and depositional conditions during the Jurassic and Cretaceous, therefore calcareous deposits dominates the central and northern parts of Israel. The stratigraphy reflects a continental shelf, the Levant margin, which separated from the Gondwana Supercontinent during the Jurassic-Triassic period.

Cenozoic tectonics, during the middle Miocene resulted in volcanic rocks that intruded into, and interbedded with, calcareous deposits in the region suggesting that some of the Phanerozoic volcanic activity in Israel and the Middle East occurred during a few, well-defined phases during the Jurassic to Recent periods. The Late Cretaceous is generally known for its volcanic quiescence. The only exception to this is the occurrence of Upper Cretaceous volcanic rocks in northern Israel. Mt. Carmel, in particular, is noted for its complex stratigraphy, structure and inter-relationships between

predominantly Cretaceous dolomites, limestones, chalks and marls, with volcanic intercalations. These stratigraphic units show marked facies changes over short distances (Figure 4).



SYMBOL	UNIT NAME	AGE
nqc	Conglomerate units, undivided - (Neogene - Quaternary)	Neogene-Quaternary
Bc	Cover Basalt and Dalwe Basalt - (Pliocene - Pleistocene)	Pliocene
p	Bira and Gesher fms.; Kurdani Fm.; Pleshet Fm.; - (Pliocene)	Pliocene
m	Hordos Fm.; Um Sabune Conglomerate; Kefar Gil`adi Fm. - (Miocene)	Miocene
Bm	Lower Basalt and part of Intermediate Basalt - (Miocene)	Miocene
emr	Maresha Fm. - (Middle Eocene)	Middle Eocene
ea	Adulam Fm. - (Lower Eocene)	Lower Eocene
sp	Mount Scopus Group - (Senonian - Paleocene)	Senonian - Paleocene
t	Bina Fm.; Derorim, Shivta and Nezer fms.; Ora and Gerofit fms. (Turonian)	Turonian
c3	Sakhnin and Yanuh fms.; Weradim Fm.; Tamar Fm. - (Cenomanian)	Cenomanian
Buc	Volcanic rock units, undifferentiated - (Upper Cretaceous)	Upper Cretaceous
c2	Deir Hanna Fm.; Chalk and limestone rock units in Mt. Carmel; - (Cenomanian)	Cenomanian
c1	Yagur Fm.; Kammon Fm. - (Albian-Cenomanian)	Albian-Cenomanian

Figure 4: Geological map of the Mt. Carmel area and legend with the main litho-stratigraphic units.

Mt. Carmel is a tectonic and topographically elevated, triangular-shaped area, bordered by a fault line scarp in the northeast, a syncline on the southeast and a wave-cut cliff on the west flanking the coastal plain. Mt. Carmel rocks are part of the Albian - Turonian marine carbonate units of dolomites and limestones with interbedded marly units, overlain by Senonian marls and chalks with some cherty lenses and beds. The intermittently interbedded volcanic rocks in this carbonate unit comprise mainly pyroclastics and minor lava flows.

During the Cenomanian to the Eocene, Mt. Carmel and its surrounding area were part of a shallow sea on the edge of a large continental platform which was partially closed off from the open sea by barrier reefs. Periods of restricted connection to the open sea led to the deposition of dolomite and limestone successions. Chalk and marls were deposited at times of good connection to the open sea (deeper sea, less light penetration).

The Kishon Valley (distal reach of the Kishon River also referred to as Zevulun Valley/graben), located immediately north of Mt. Carmel, represents an asymmetric graben with a steep south-western boundary and a gentle slope to the northeast. It is bordered by the uplifted area of the Shefar'am Tiv'on syncline in the southeast. The basin is bordered by the Carmel Fault in the southwest and the Ramat Yohanan Fault in the northeast. The Late Cenozoic valley-fill sediments provide an almost uninterrupted depositional record of the area and in particular the development of the Kishon River. The Kishon River is the principal drainage of the Galilee plateau and mountains and enters the Mediterranean Sea just north of Haifa. The Kishon Graben extends westwards and offshore into the Haifa Bay and functions as depositional basin for sediments eroded from Mt. Carmel, Lower Galilee, the Yizre'el Valley, Ramot Menashe (in part) and the northern Samaria hills east of the Mediterranean Sea.

During the Pleistocene and Holocene cycles of transgressions and regressions prevailed on the Mediterranean east coast. The sea level rise, with the transgression of the coast to the east, deposited marine sediments in the Kishon River Estuary that partially blocked the water flow to cause large parts of the terrestrial area to be flooded or become a swamp. Along with the sea level rise and after it stabilised, the Zevulun graben was filled with marine and coastal sediments that caused the shoreline to retreat again westward to its present location (Kafri and Ecker, 1964). The farthest inland (farthest transgression) marine sediment of late Miocene age is found at Tel Kashish, the border between the Proximal and Mid-Reaches of the Kishon River.

7.1.2. Regional Structure

In the Mid-Miocene, regional Red Sea rifting tectonics established the Dead Sea transform fault, with the Kishon graben representing the extreme western graben of this system. Vertical movements and tectonics have deformed the relatively tectonic quiescence regime of the Cretaceous-Eocene Levant carbonate platform and continental margins. This tectonic activity resulted in significant relief in the plates. The Carmel Fault (the southern boundary of graben) experienced vertical offset and so exposed the buried Lower to Mid Cretaceous rocks and formed the Kishon River distal base level upon which the headwater part of the Kishon drainage basin was established. Cretaceous-Eocene rocks outcrop on the eastern parts of the graben while the western part subsided and the graben started to fill with younger sediments.

The lower Galilee region is composed of a series of valleys (80km long) divided by hills of which the highest peak is 600m amsl. Two subsidiary basins from north to south respectively, are Ta'anach and Kesulot that are part of the Yizre'el Valley. From the south it is topographically and structurally

bordered by Mt. Carmel, Ramot Menashe, Umm El-Fahm and Mt. Gilboa. These folds trend to the north-northeast unlike Mt. Carmel which strikes to west-northwest (Figure 5). The current geomorphology, therefore, is a product of continuous tectonic subsidence since the Neogene and is still active. Most of the subsidence predates the Pliocene period.

The palaeogeography of the Galilee region during the Mesozoic was largely influenced by a major Late Cretaceous folding event. The Cretaceous relief was submerged and Eocene sediments accumulations concealed the relief. Oligocene regional uplift and erosion left pockets of sediment in the deepest basins. This peneplain surface serves as a datum for later Neogene tectonics (Wald, 2015).

A well-established floodplain formed by the Kishon River's Middle and Lower Reaches have developed immediately north of Mt. Carmel. Due to the structurally-induced elevation of Mt. Carmel, the Senonian calcareous rocks are well-exposed along its south-eastern boundaries and in the adjacent syncline. Volcanic bodies occur at various levels and localities within the Cenomanian to Senonian calcareous sequences. They are lenticular and their distal and thin continuations overlap in some cases. At the end of the Pliocene-Early Pleistocene, uplift and displacement along the Dead Sea rift, influenced the branching of the Gilboa-Carmel fault system, the region underwent faulting, tilting and uplifting, combined with volcanic activity in the drainage basin of the Kishon. The increasing uplift accelerated erosion of the western Galilee region and Carmel and therefore sediment supply into the deposition basin.

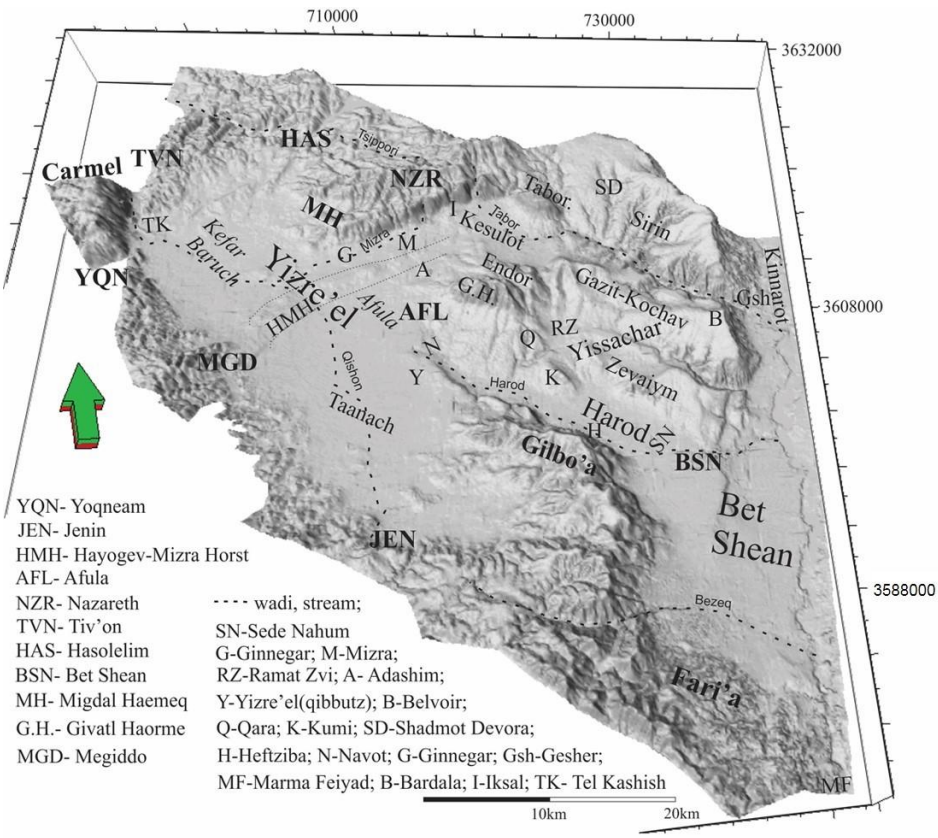


Figure 5: Structural basins in the lower Galilee region

7.2. Local Geology

Cretaceous to Cenozoic Rocks

The basement substrate within Shefa Gems' permit areas are exposed in the elevated terrain represented by Mt. Carmel and the lower lying northern hilly terrain flanking the Zevulun and Yizreel valleys. This substrate comprises mainly carbonate rocks (dolomite, limestone, chalk and marl) intruded by volcanic rocks. The stratigraphy indicates a continental shelf setting, the Levant margin, which rifted apart from the "Gondwana" super-continent during the Jurassic-Triassic and later was covered by the Tethys Ocean.

During the Cretaceous, marine carbonate deposits covered the shallow continental shelf. In the Carmel area, volcanic eruptions occur as several events within the carbonate column formation. These rocks spatially appear as patches across the Carmel structure and are correlatable within various geological rock units in terms of the age of their eruptions.

At the end of the Cretaceous during the incipient closure of the Tethys Ocean, a regional compression regime occurred in the entire region, from Sinai to Syria, creating the Syrian arc fold belt. During the Eocene, an extensive marine transgression deposited marine-sedimentary rocks of open sea environment on the Cretaceous stratigraphic column.

The Kishon River valley, the focus of Shefa Gems' exploration campaign, is located on a series of NW-SE structural basins cross-cutting the central highlands of Israel (Figure 5), where it drains the Yizre'el (Proximal Reach) and Zevulun (Distal Reach) valleys and the intermediate Mid-Reach corridor.

During the Eocene, an extensive marine transgression deposited marine sediments of an open sea environment on the Cretaceous stratigraphic column and moderated the folded landscape by filling the synclines. In the Oligocene, the global regression caused a withdrawal of the sea to the west and exposed the region rocks creating an extensive drift from east to west (prior to formation of the Dead Sea rift) that drained the entire Galilee region and Transjordan to the west – to the Levant basin (Mediterranean Sea of today). The current geomorphology is a product of tectonic subsidence, commencing in early Miocene, peaking before the Pliocene and is still continuing today. Since the Oligocene regional Arabian uplift, the area was exposed and denudated, hence most of the rock record is continental or fluvial.

During the Miocene, northwest-trending normal faulting caused basin subsidence and sub-catchments evolved. Mainly basalts of the Lower Basalt Formation (Schulman, 1962) and some local tuffs as products of a prolonged volcanic activity filled the valleys. The magma intruded along large fault systems as dykes and volcanoes (Schulman, 1962; Shaliv, 1991). Basalt composition is predominantly olivine-alkaline (Oppenheim, 1962). Most of these bodies are aligned to the northwest along with the structural features – faults and fractures.

Continental environmental conditions prevailed as the area was exposed during the Oligocene, and sedimentation was dominated by terrestrial conglomerates, syn-tectonically embedded within the valleys. A clay unit comprising fluvial clay accumulations overlie this conglomerate unit. The conglomerates comprise pebbles of older carbonate rock units as well as basalts. The clay series consists of brown smectite clay and marly brown-red clay, interbedded with minor accumulations of calcite, pebbles of chert and limestone. The Kishon drainage system was established during the Pliocene and drained the areas underlain by rocks of Mt. Carmel, including volcanic complexes basalts of the Lower Galilee.

Neogene Volcanism

Volcanism during the Mid-Late Miocene (Lower Basalt Formation) was characterised by extension and faulting across the entire region. This extensional stress regime included northwest-southeast trending faults and grabens, enabling mantel-derived molten rocks to reach the surface. Volcanism was focused in the valley margins adjacent to normal faults.

These substrate units were, and are still being, drained into the Kishon River valley and deposited as part of the Mid-Reach multi-commodity placer that is dominated by gemstone varieties of corundum. The weathered derivatives from these basalts, notably clays (non-placer minerals) and corundum varieties (potentially placer-forming minerals) have drained into and through the narrow, structurally-confined Mid-Reach of the Kishon valley where additional trapping from oversize clasts, derived from Mt. Carmel alluvial fans, have promoted placer development (Toledo *et al.*, 2015).

Mt. Carmel Stratigraphy

The Shefa Gems' exploration and prospecting areas are predominantly underlain by limestones and dolomites of the Albian-Turonian Judea Group. The stratigraphy of Mt. Carmel is complex as a result of the facies changes over short distances and the variety of volcanic rocks intruding the sedimentary units. The currently accepted litho-stratigraphic nomenclature of units in the Mt. Carmel area uses the radiometrically datable volcanic intrusions as time markers.

Four sedimentary-volcanic cycles were identified by Segev and Sass (2009):

- Cycle I: The first sedimentological cycle is represented by the Yagur and Talme-Yafe formations (Albian age). The Yagur formation represents an inner reef, in well-stratified environment, which led to the accumulation of thick layers of dolomite rocks, while the Talme-Yafe formation consists of chalk layers (with chert lenses), which were deposited west of a reef barrier in an open water environment. An erosional unconformity terminates this first sedimentary phase.

- Cycle II: The second cycle shows the subsidence of the carbonate platform, with the onset of the first volcanic phase V1, The V1 phase tuffs (called the Maharal tuffs) correlate with the Isfye Formation (Albian age). The lower part of the Isfye Formation is called the Bet Oren

limestone, followed by chalk with chert laterally changing to dolomite. This erosion surface was subsequently covered by the Isfye Formation.

- Cycle III: The third cycle began with a second volcanic phase (V2, The V2 phase tuffs (Tavassim tuff) correlate with the time-equivalent Arkan and Zikhron carbonate formations. The Arkan Formation chalks (local chert nodules) and limestone, are found mainly in the northern parts of Mt. Carmel, representing an open-sea environment while on southern Carmel the Zikhron Formation rocks, which are more dolomitic, representing rather a closed basin environment, were formed. An inner-cycle third volcanic phase (V3), which occurs as a basalt horizon, (Rakefet basalt) is interbedded in the layers of the Zikhron Formation.

- Cycle IV: The fourth cycle began with the onset of the fourth volcanic phase (V4). The V4 rocks (Shefeya pyroclastic horizon) are composed of tuffs and basalts and their formation took place during the deposition of the time-equivalent Bina and Sakhnin Formations. The Bina Formation is composed mainly of limestone and the Sakhnin Formation is composed mainly of dolomite. The two formations occur with rather sharp lateral changes and represent environmental changes that took place during their deposition due to the development of reef barriers, which separated between open-sea and back-reef environments.

- A fifth volcanic phase (V5) took place 13.4Ma later and appears in one location only – near Bat-Shelomo. It is represented as pyroclastic rocks (named Bat-Shelomo tuffs), which occurred intercalated with the Ein-Zeitim Formation (Senonian age) and radiometrically dated at 82Ma. The stratigraphic sequence of the Carmel rocks is presented in Figure 6.

Most of the volcanic rocks in Mt. Carmel are pyroclastics of basic composition, with subordinate lava occurrences interbedded with carbonates of Mt Carmel (Figure 7).

Pyroclastics:

The constituents of the pyroclastics are:

- Juvenile ejecta that are represented by ash, made up of micro-vesicular glass in various degrees of preservation.
- Other juvenile components are lapilli and volcanic bombs. These ejecta are rich in micro-vesicles and consist of black glass (sideromelane), altered olivine phenocrysts, and microlites of augite and plagioclase.

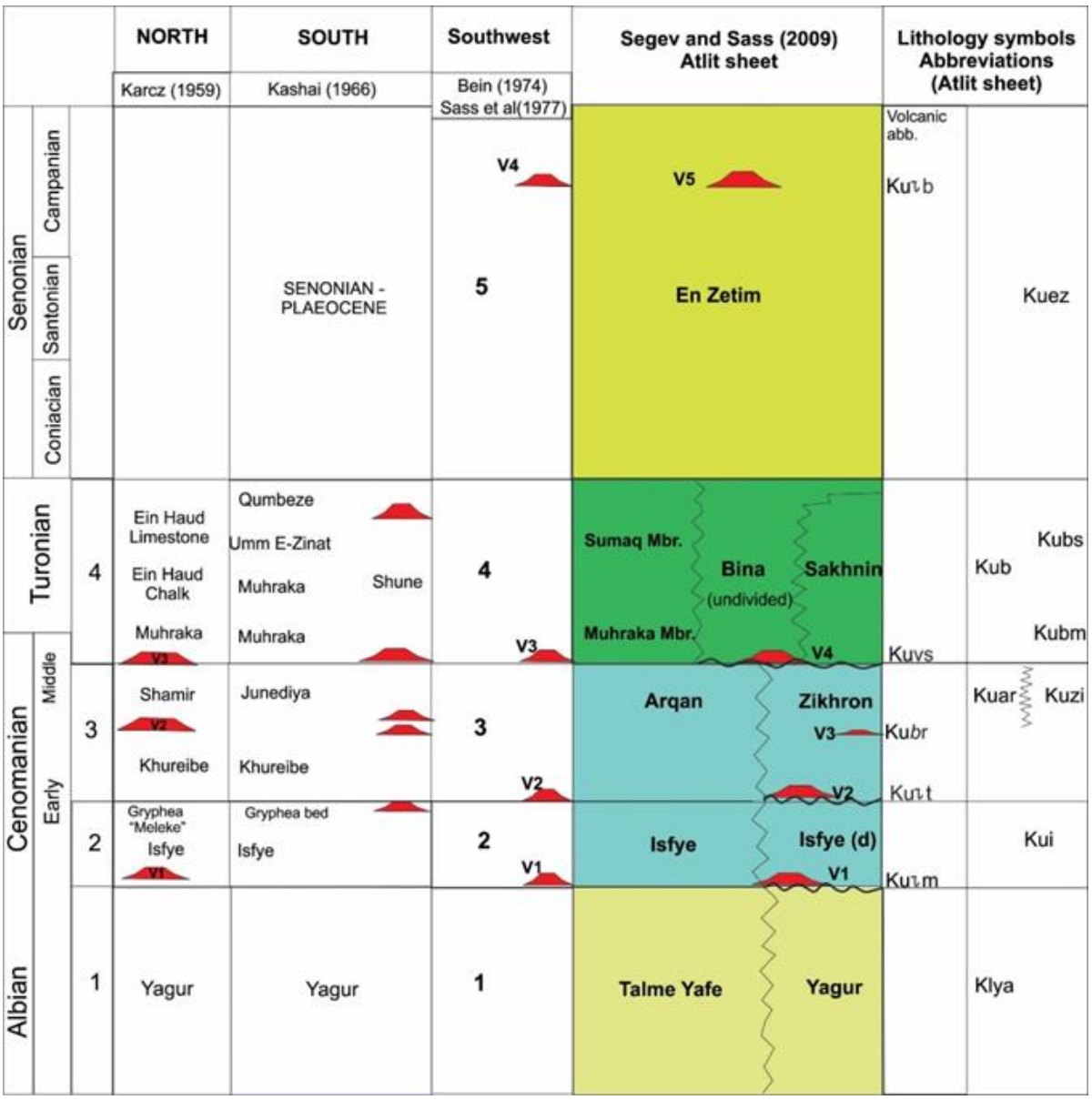


Figure 6: Lithostratigraphy of Mt. Carmel modified from Segev and Sass (2009). V1 - V5 volcanic phases are evident.

Accessory lapilli and blocks are similar in composition and vascularity to the juvenile fragments, but have higher crystallinity. Based on the acid composition of the plagioclase (albite-oligoclase in most cases, and only rarely andesine), these ejecta are recognised as spilites. Rocks of similar microscopic appearance are known among the few lava occurrences in Mt. Carmel.

Xenoliths of limestone and dolomite are from the strata which immediately underlie the respective pyroclastic bodies and represent, therefore, the explosion products at the vent. These fragments are surrounded by a rind of friable, structureless carbonate. This rind seems to be the original decarbonised zone in contact with the hot magma, which was later re-carbonated. Mafic xenoliths consist of various gabbroic rocks. Here olivine gabbro, meta-andesine-olivine gabbro and melo-andesine-olivine-hypersthene gabbro are most prevalent. Ultramafic xenoliths are also present.

Figure 7: Mt. Carmel volcanic rock outcrop (foreground) overlain by calcareous rocks (background).

Three main pyroclastic facies associations are present. The distance from the eruption centre can be estimated by the degree of the pyroclastics' alteration and their colours – black or dark grey represent the more massive (and therefore less altered) rock, which was formed closer to the vent while yellowish to light brown tuffs represent a more distant location from the centre of the eruption, in places it occur as clay containing completely altered pyroclasts.

- *Black Pyroclastic Association.* The least altered pyroclastic rocks. These consist of vesicular and micro-vesicular, almost fresh sideromelane, with few microlites of plagioclase and fine-grained ore minerals. The black pyroclastics are massive in appearance and they virtually lack any bedding structure. Their ejecta are large (up to 1.5m). The black pyroclastics are the least common among the pyroclastic associations and their lateral extension is limited to a few hundred meters.
- *Variegated Pyroclastic Associations.* Contains the most diversified pyroclastic types. Typical occurrences are well-bedded and are grey, brown, yellow, red, and green. Some however, are more monotonously greyish or reddish. The rocks consist of tuffs, lapilli tuffs and agglomerates, and contain volcanic bombs and various other ejecta that are up to a few dozen centimetres across. The coarser lapilli tuffs and agglomerates are usually grey, whereas the finer tuffs acquire reddish and greenish colours. Thus, a relationship between grain size and degree of alteration is indicated. The variegated pyroclastics extend over distances of up to 2 - 3km.
- *Yellow Pyroclastic Associations.* It mostly consists of very well thinly-bedded, yellow to brownish fine-grained tuff. Secondary calcite and a mixture with original carbonate sediment are quite

common and, where abundant, are responsible for an off white appearance. The yellow tuffs have the largest lateral extension with a distance of up to 6km.

- *Lavas*. Lava flows occur in only a few localities in southern Mt. Carmel. They are apparently all of the same age, even though different sources of eruption were involved. The lava flows occur as dense and vesicular varieties, which are closely associated in some localities. The preservation of the lavas is in most cases very poor.

Fourteen volcanic bodies in the greater Mt. Carmel area occur within Shefa Gems' permit areas. The most exciting discovery to date is the mineral assemblages of the volcanic rocks. Shefa Gems has demonstrated that some of the fourteen volcanic bodies have mineral assemblages that are compatible with kimberlitic sources (Apter *et al*., 2014; Apter, 2014). Diamonds have been recovered from the magmatic rocks and its erosional deposits in the Kishon River valley along with gemstone variety corundum such as sapphires and rubies, as well as natural moissanite.

Kishon Valley-fill Geology

The Kishon Valley has been divided into three parts, namely the Distal, Mid and Proximal Reaches, based on morphological variation (Figure 16). The Proximal Reach represents the drainage basin up-valley from the volcanic bodies of Mt. Carmel, where degradational rather than aggradational processes prevail. However, it plays a role in supplying heavy and gem minerals into the Kishon Mid-Reach. Special attention is given to basalt deposits in the Yizre'el basin, the weathering products of which have been transported through, or deposited in, the Kishon Mid-Reach.

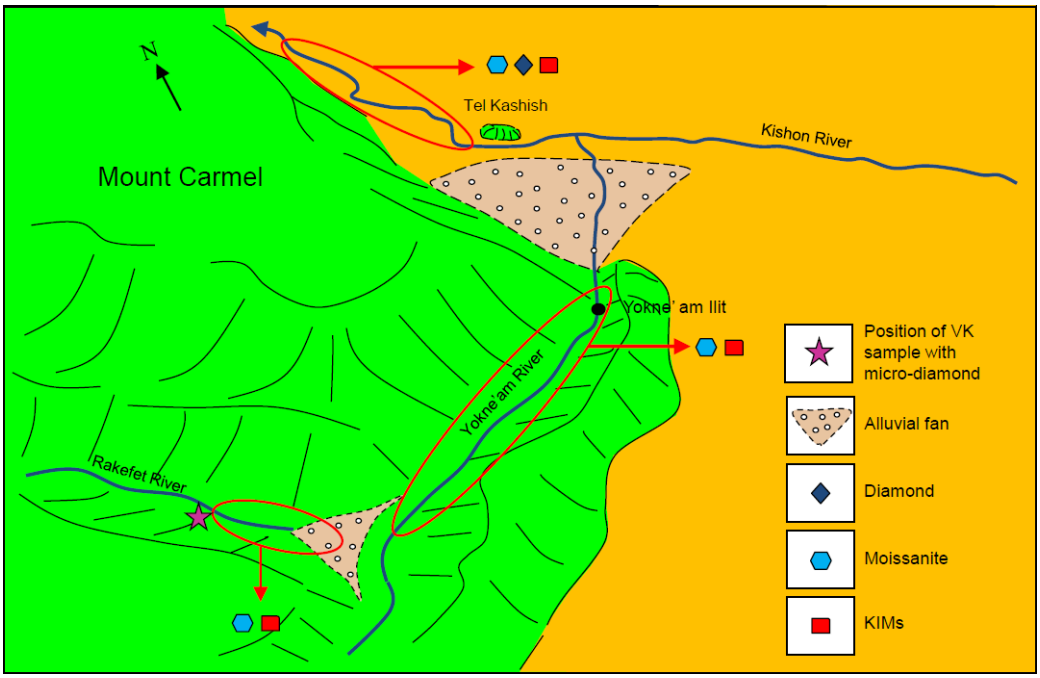


Figure 8: Simplified diagram showing mineral distribution in alluvial deposits of the RMC-Yoqneam-Kishon drainage system (Toledo *et al*., 2010).

These weathering and erosional products are predominantly clays (overburden, barren of placer potential) and the resistant corundum (ruby, sapphire and Carmel Sapphire ™) that, to date, make

up the principal components in the Kishon Mid-Reach Placer (Bluck *et al*. ,2005; Griffin *et al.*, 2016; Wald and Toledo, 2016). As a total estimated volume of some 300 000km^3 basalt is present in the lower Galilee region, the supply and transportation of basalt weathering products becomes important. Recent discoveries of titanium-rich corundum called Carmel Sapphire ™ appear to be unique to the Mt. Carmel and immediate surroundings (Figure 8).

Mid-Reach

The significance of the Mid-Reach lies in the fact that it is just down valley from the Rakefet Magmatic Complex (RMC) and the effect that this constricted valley morphology in this part of the valley (Figure 2) has on placer development. Other volcanic bodies on the eastern margins of Mt. Carmel (Muhraka and perhaps Har Alon & Beit Oren) may also have contributed to placer deposits in the Mid-Reach via short, steep tributaries across the eastern slope of Mt. Carmel (Figure 1). This section of the valley is therefore considered to be highly prospective in terms of placer deposits.

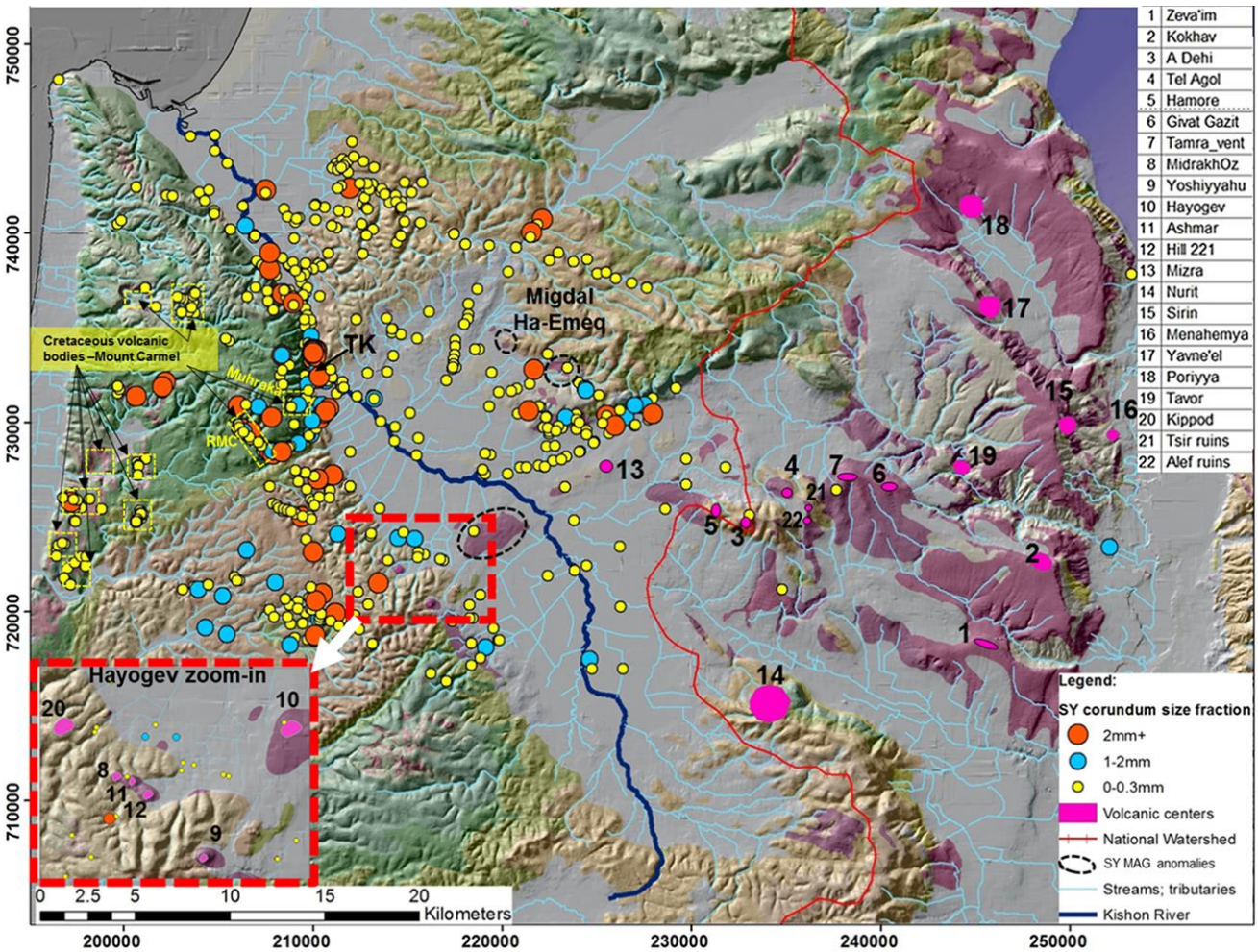


Figure 9: Inferred Neogene volcanic sources and corundum recovery locations and size fractions. Volcanic centres and assumed vents are shown in magenta polygons. Note the association between corundum recoveries (gem derivatives sapphire and ruby) and proximal volcanic sources, as well as point sources from Mesozoic volcanic bodies on Mt. Carmel.

A typical profile of the valley-fill sediments in this section is shown in Figures 10 & 11.

The Mid-Reach valley-fill assemblages represent two main lithological units:

- A sandy-clay overburden. These Pleistocene to Recent sediments are predominantly dark-brown coloured and represented by clay, silt, calcareous sandstone, and occasional suspended gravel distributed along the recent river flood plain and tributary channels. Silty sand and gravel may contain subordinate angular dark basalt clasts. Total unit thickness varies from 3 – 6m on average.
- A gravel layer consisting mainly of reddish-brown coarse sand and silty clay matrix. There is a clear unconformity at the base of the unit. Pebbles and cobbles, with an average size of a few centimetres (maximum 20 - 80cm), consist of mainly locally derived carbonate (20 – 65%), mixed with white quartz and black and brownish flint (3 – 10%) and minor grey marls (0 – 15%). Sub-rounded dark-coloured basic rock pebbles are always present (1 – 10%). The alkaline basic rock pebbles range from a few mm up to 20cm in size. These are composed of basanite, olivine basalt, melilite, tephrite, and basanitic nephelinite as well as Miocene gravel. Total unit thickness varies from 3 - 6m.

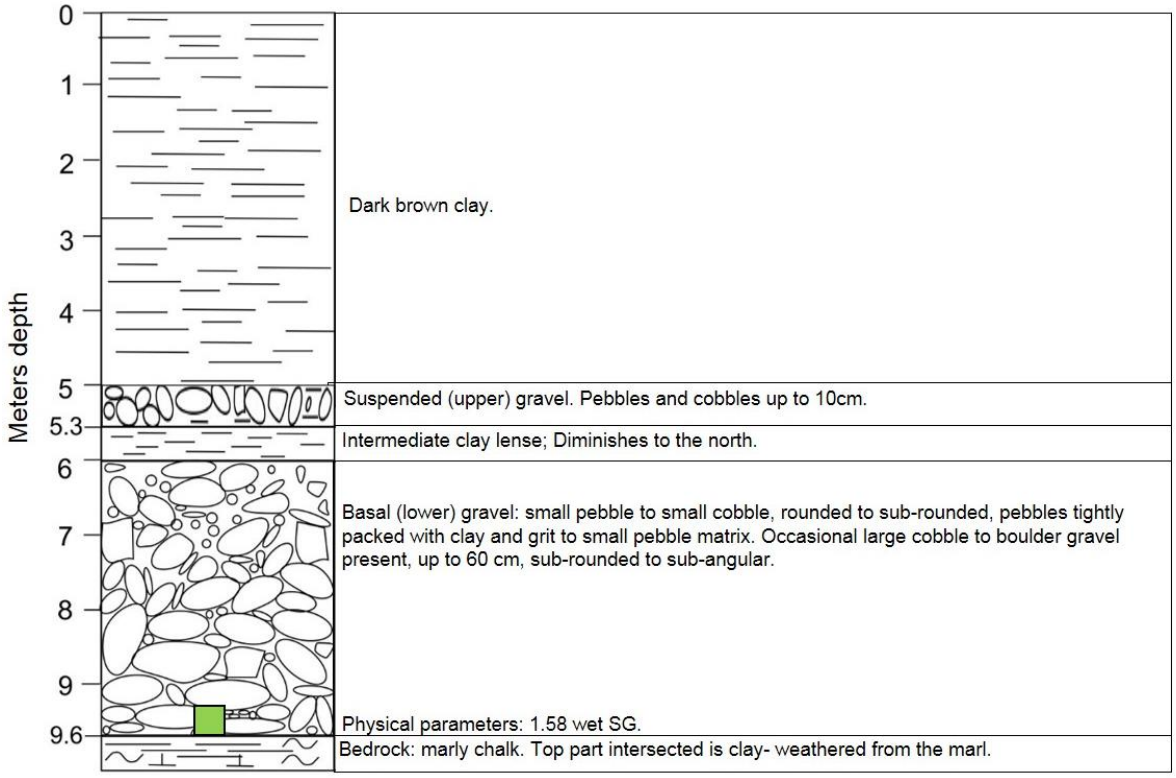


Figure 10: Typical profile of the Kishon River valley-fill in the Mid-Reach.

Headwater streams of the Kishon River eroded minerals from the volcanic bodies from the Galilean valleys and Yizre'el valley margins and the Zippori main tributary draining the Nazareth range, as well as shorter reaches from Mt. Carmel. These also acted as conduits for sediments being transported down to the Kishon River floodplain. It is therefore to be expected that the gravels of the Kishon River would contain diamonds, moissanite, sapphire, garnet , spinel, ilmenite and ruby varieties of corundum and the hibonite (“GEM Box” minerals).

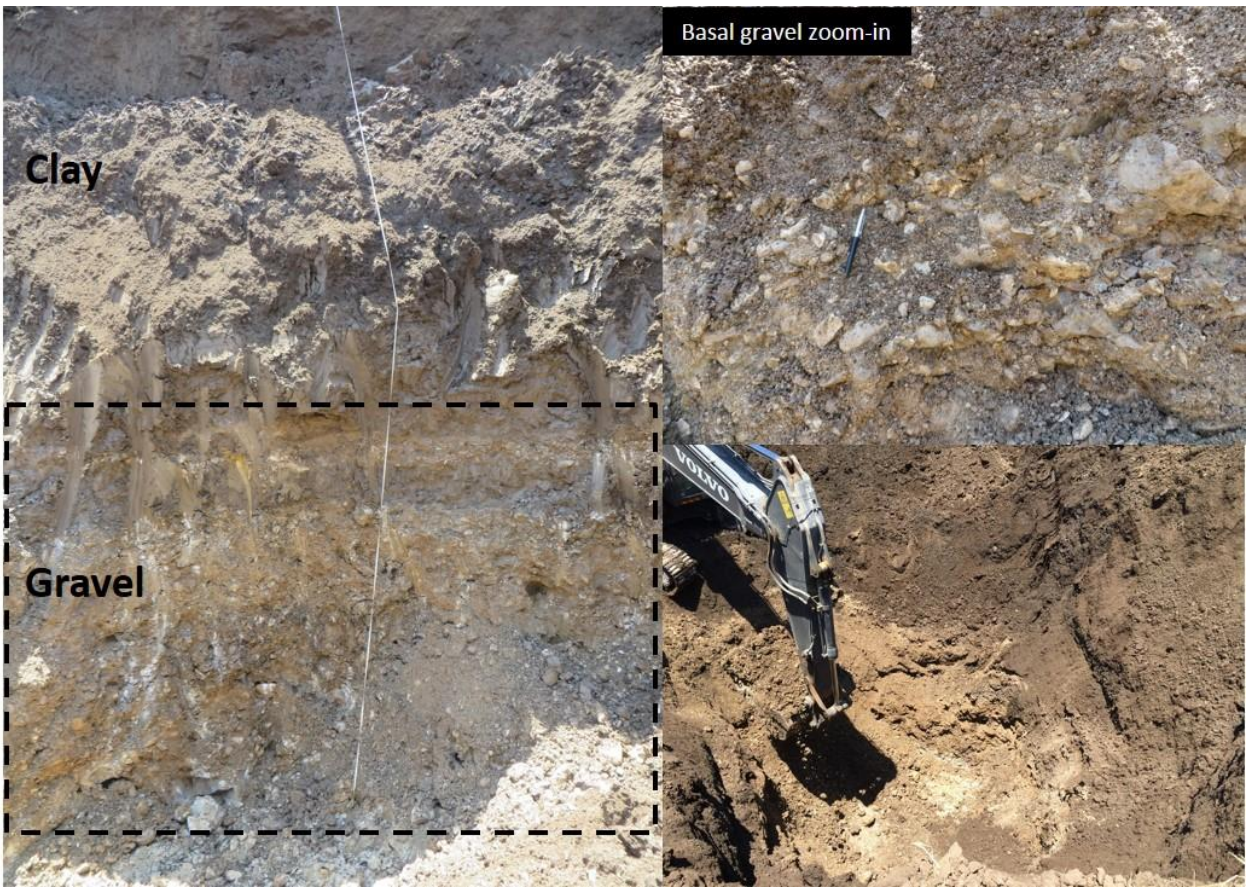


Figure 11: Photo mosaic of a bulk sample excavation showing the Kishon valley-fill sediments.

GEM Box minerals would have been fed into the Kishon River and trapped in energy-specific areas in favourable channel-morphological settings in the river to allow the concentration of GEM Box minerals in favourable sites to form placer deposits. These alluvial deposits, made up entirely of unconsolidated gravel, sand and clay with GEM Box minerals hosted in the gravel fraction, represent the Kishon River valley placer target.

From its headwaters to the Mediterranean Sea, only certain parts of the Kishon River system contain an abundance of GEM Box minerals. Shefa Gems' source (volcanic rocks) to sink (Mediterranean Sea) model thus guides exploration to target high-interest areas first, thereby reducing time and maximising potential.

The model shows that the middle reach of the Kishon valley, referred to as the Mid-Reach, is of particular interest. It has greater potential due to geological features that are highly favourable for trapping heavy minerals including precious stones. The Mid-Reach is undergoing rigorous exploration that is in an advanced stage to determine its exploitable potential (Toledo *et al*., 2015; Toledo *et al*., 2016).

Distal Reach

The Distal Reach of the Kishon River and its valley-fill sediments are the main occupant of the Kishon Graben. The Kishon River's Distal Reach valley-fill sediments comprise Neogene and Quaternary fluvial and marine assemblages, which represent four main lithological units:

- Light, sandy limestone, chalk, reddish coloured clay and calcareous sandstone, and gravel. Well-rounded gravel consists of pre-Cretaceous clasts mixed with minor amounts (1 – 2%) of dark alkali-basalt and basanitic nephelinite typical of mantle-derived volcanic rocks. The gravel is mainly cemented with a reddish-brown sandy, clay matrix. Maximum observed thickness of the unit is 174m.

- Grey-coloured marl, clay, gypsum, and marble succession. It unconformably overlies the limestone of the underlying unit and is found in most boreholes. The succession represents lagoon sediments deposited in relatively high, water salinity environment. This unit has a Pliocene age and a total unit thickness that varies from 35 - 120m.

- A gravel layer consisting of mainly reddish-brown coarse sand and a silty clay matrix. There is a clear unconformity at the base of the unit. This unit forms a continuous horizon over a distance of about 2.5km and splits into several horizons to the northwest, reaching a 7 - 8km length in total. Pebbles and cobbles with an average size of a few centimetres (maximum 20 - 50cm) consist mainly of locally-derived carbonate (20 – 65%), mixed with white quartz and black and brownish flint (3 – 10%) and minor grey marls (0 – 15%). Sub-rounded dark-coloured basic rock pebbles are always present (1 – 10%). The alkaline basic rock pebbles range from a few mm up to 20cm in size. These are composed of basanite, olivine basalt, melilite, tephrite, and basanitic nephelinite. Total unit thickness varies from 18 - 92m.

- The Pleistocene to Recent sediments are predominantly red-coloured and represented by clay, silt, calcareous sandstone, and rare gravel distributed along the recent river and tributary channels. Silty sand and gravel contain minor amount of angular dark basalt clasts. The alluvial and aeolian continental sediments are replaced by dune sand, and meters-thick ephemeral marine lagoon sediments toward the northwest. Total unit thickness varies from 17 - 155m, 60 – 65m on average.

7.2.1. Deposit Type and Mineralisation

The Rakefet Magmatic Complex (RMC) is considered to be one of the primary sources of GEM Box and related heavy minerals. Stream sediment analyses showed this area to be a key source area for the mineralisation in the Mid-Reach of the Kishon River.

Shefa Gems has recovered (De Beers report dated June 4, 2004) a micro-diamond from an in-situ rock sample from the Rakefet volcanic body, and diamonds in down valley sediments in the Kishon River floodplain. High concentrations of sapphire, rubies and moissanite were also recovered with a host of other heavy minerals from the gravels in streams draining from Mt. Carmel to the Kishon River and in the Kishon River floodplain itself.

The mineral assemblages from the volcanic bodies (kimberlite) have been termed KIMs and are mainly represented by garnet, ilmenite, chromite and clinopyroxene and other high-pressure minerals including corundum and hibonite. In addition, Shefa Gems identified a multi-commodity assemblage called the TMA comprising two mineral suites: the HIM (Heavy Industrial Mineral Suite - rutile and zircon) and GEM Box (Diamond, Moissanite, Corundum - sapphire, ruby, Carmel Sapphire™, spinel, garnet, ilmenite and hibonite) suites. The mineral chemistry of the garnets exhibits some very unique attributes with one population of garnet (peridotitic) that has low chrome values (<2wt%) suggesting that these minerals have come from shallow depths (about 60km) and are not associated with the diamond stability field, a region at greater depth where diamonds form (Apter *et al*., 2014). However, the second garnet population (eclogitic), which is also inherently low in chrome (<2wt%) has sodium oxide values of >0.07wt%, pointing to much deeper regions with pressures approximating those in the diamond stability field (Apter *et al.,* 2015). It has been demonstrated that diamonds are also derived from eclogite source rocks, thus in exploration applications, eclogite garnets with sodium oxide values >0.07wt% are considered significant in that they are associated with diamonds (Gurney *et al.*, 1993). This would explain the recovery of a micro-diamond in an in-situ sample taken from one of the volcanic bodies (Apter and Burgers, 2004). A micro-diamond from the volcanic rock provides sufficient evidence to suggest that some of the Mt. Carmel volcanic bodies are kimberlitic in nature and are likely to be diamond-bearing even though low-chrome peridotite garnets are present. Exploration results continue to show that the volcanic bodies within Shefa Gems' permit areas are the source of these TMA minerals. Erosion of these bodies over prolonged periods would have released TMA minerals into a drainage network where they would accumulate as placer deposits with the Kishon Valley as depositional basin with a large accommodation potential for placer deposits.

Sampling data at present indicates that appreciable quantities of diamonds are not present in the deposits investigated, however, a multi-commodity deposit of abundant gem quality corundum (including sapphire, ruby and Carmel Sapphire™), moissanite, garnet, spinel, ilmenite and rare diamonds (GEM Box) constitutes the mineral assemblage of interest representing exceptional high-quality gems. It is the gem-quality corundum and moissanite that are of particular significance to Shefa Gems and are targets of potential economic interest. Natural moissanite is exceptionally rare and is only found in a few placers worldwide, usually as tiny crystals, less than 1.5mm (see Fritsch *et al*., 2014). Yet, Shefa Gems has recovered over 3 000 crystals since the inception of their exploration programme including the two largest to date – world records – measured 4.1mm (GIA, 2015) and 4.14mm (Toledo *et al*., 2016).

In addition to moissanite, gem corundum (ruby and sapphire) and Carmel Sapphire™ are also found. The Carmel Sapphire ™ is a titanium-rich variety of corundum that appears to be unique to the Shefa Gems permit areas. It takes a good polish and has unique qualities that distinguish it from typical sapphire. Sapphire occurs in abundance with about 4 000 crystals having been recovered to date; the

largest weighing 5.72 carats. Most sapphires are dark blue, but brighter colours of pink to red or a violet-blue are not uncommon. Rubies are deep red-pink and exhibit good clarity.

8. Previous Work

Apart from some oil, industrial mineral and base metal exploration in Israel, the country has not been receiving much attention as an exploration and mining target for mineral commodities, let alone precious stones. However, this was to change with the first diamond discovery in the region in northern Israel in 1999. Diamonds have also been reported from the Dreikeesh area in Syria in 2002. These occurrences are related to the Cretaceous volcanic activity.

In 1999 Shefa Gems began to explore the Mt. Carmel volcanic rocks and sedimentary deposits of their erosional products in the Kishon River Valley. During the period 1999 to 2000, drilling of 10 deep boreholes took place over an 8km distance along the down-valley profile of the lower reaches of the Kishon River Valley, located immediately north of Mt. Carmel. This drilling by Shefa Gems was done using a 63mm diameter rotary drill. The core was analysed in terms of its heavy mineral content and lithology. Detailed mineralogical analyses of the heavy mineral fraction obtained from the Kishon River valley core revealed abundant KIMs. A total of 64 diamonds (63 micro-diamonds of 0.12ct in total and one 0.88ct stone) were also recovered.

Natural SiC is very rare and has been found as tiny crystals (usually less than 1.5 mm) in only a few deposits worldwide (Bauer *et al*., 1965; Shiryaev *et al*., 2011 and references therein). Over the past 18 years, more than 3 000 crystals of natural moissanite have been discovered by Shefa Gems. The crystals come from primary and alluvial deposits. In 2000, the company unearthed moissanite crystals ranging from 0.1 to 1mm in size; although throughout the years the crystals they found got larger and during 2015 a crystal of 4.14mm was recovered - the largest crystal to date.

During the years 1999 - 2000 the company initiated a surface sampling programme. Surface samples collected on the flood plain of the Kishon River during 2003 to 2004 indicated the presence of two populations of heavy minerals (Levin and Kalmanovich, 2006). The Corundum – Moissanite population was found to be prevalent along the northern part of the flood plain and northern valley flanks indicating a source to the north of the Kishon River Valley. The predominantly Pyrope – Spinel population occupying the southern flanks of the Kishon River valley suggests Mt. Carmel as the provenance. From here on the research was focused on the samples that produced the highest number and biggest pyrope garnets. Plots of these data indicated tributaries draining Mt. Carmel as the conduit of garnet supply.

In early 2003 Shefa Gems started to collaborate with De Beers, South Africa. Collaboration included field work, laboratory processing, petrographic analysis and micro-probe data. To date several rock and soil samples were collected for analysis in the De Beers laboratories during each of the field visits by De Beers's geologists. De Beers Exploration (Africa) division shared their findings on diamond recoveries from the drilling programme with Shefa Gems on a continuous basis. The De Beers

Exploration (Africa) team recognised the abundance of typical KIMs, which they reported as garnet (predominantly eclogitic type), ilmenite (including picroilmenite), clinopyroxene and spinel (chromite), from both rock and soil samples collected by its geologists (Apter and Burgers, 2004; Burgers, 2004).

Significantly, the De Beers team also used conventional follow-up methods to identify the Mesozoic Rakefet volcanic body as a primary source of typical KIMs (Apter and Burgers, 2004; Burgers, 2004). During the same investigation, Kerem Maharal was identified as a primary source of moissanite and the Rakefet pyroclastic – volcaniclastic rocks were reported as having sufficient kimberlitic affinities to be called a kimberlite rather than a para-kimberlite (Burgers, 2004). The De Beers team also dated detrital zircons collected from the Kishon Valley sediments, returning a range of ages from 2 490 million years (Ma), 2 200Ma, 650Ma, 166Ma, 71Ma to 11Ma.

The Inspector of Mines requested Magma Ltd to collect and analyse three 25kg samples – from the Kishon River, Kishon terrace and Rakefet – for their mineral compositions. This work corroborated the KIM's results reported by Shefa Gems (Kalmanovich and Roup, 2007), thereby satisfying the authorities that its results were indeed indisputable (Gore, 2005).

In February 2004 a De Beers report was produced supporting the Shefa Gems mineralogical findings from the Kishon River valley. The garnets were all found to be eclogitic, possibly high-pressure varieties. Garnets from the boreholes in the alluvium of the Kishon River valley are similar to those from the volcanic and pyroclastic rocks. The borehole-derived garnets were described by De Beers as "low Cr eclogitic, not megacrysts as the CaO content was marginally too high, being similar to Kaapvaal Group-1 and diamond–bearing eclogite in terms of analysed CaO, FeO, MgO, and unlike lower crustal eclogite and granulite garnets." The spinels (chromite) and clinopyroxenes complement each other to imply a derivation from a shallow spinel-peridotite 'mantle' and not from the diamond stability field (Apter and Burgers, 2004).

The ilmenites present two separate chemical populations. A larger kimberlitic population suggests a shallow mantle origin and complements the spinel and clinopyroxenes with respect to mantle origin. The other minor ilmenite population is more typically kimberlitic (although Cr_2O_3 values are low), possibly complements the eclogitic garnets, and compositionally may be derived from a deeper mantle or higher-pressure regime.

Based on the indicator mineral chemistry of the minerals analysed, the source rock appears to have two separate mantle regimes. A shallow, non-diamond stability field of a peridotitic source and a higher pressure (deeper) eclogitic source which, based on the garnet compositions, is 'possibly diamondiferous'. Indicator mineral chemistry provides an indication of the diamond potential of the source rock, but the confidence with which this may be applied is more readily applicable to cratonic or shield settings (i.e. thick lithosphere). The setting of the Mt. Carmel source on the flank of a recently active rift-zone is uncommon considering a possibly diamondiferous source. It is therefore

crucial to note that the final word on the Mt. Carmel source rock being diamond-bearing depends on whether it can positively demonstrate that diamonds can be derived from this rock.

The four samples collected for petrographic analyses were described by De Beers as more akin to being "kimberlitic" in nature while an alkali-basalt or basanite source is excluded (Apter and Burgers, 2004). Petrographically the samples were classified as re-sedimented and primary pyroclastic, crater facies, kimberlitic rocks. Some samples exhibit an oxidised, granular, matrix-supported, poor- to moderately-sorted, finely-bedded, carbonate-rich re-sedimented volcaniclastic kimberlite. Altered, massive, matrix-supported, moderately-sorted, volcaniclastic kimberlite and clast-supported, poorly sorted, welded, lapilli tuff kimberlite was also described. Geochemically the major and trace elements from the four samples from Mt. Carmel are kimberlitic with variable dilution by crustal material. The trace element ratios clearly indicate a kimberlitic nature with a possible metasomatic influence or enriched source similar to kimberlites from West Africa.

A report by De Beers in June 2004 documents the recovery of one diamond of 0.000003ct from the samples collected, with the sample size being 252.08kg. These findings led Shefa Gems to include the following four Mt. Carmel volcanic bodies (previously part of the Prospecting Permit): Rakefet Magmatic Complex (RMC), Muhraka, Har Alon and Beit Oren in all future Exploration Permit applications. In addition, a sampling programme running in parallel with the alluvial exploration was designed for the Upper Cretaceous volcanic outcrops in the Mt. Carmel area.

During November to December 2004, three large diameter (1m) auger holes were drilled in the Distal Reach of the Kishon River valley that produced most favourable results during the 1st drilling phase. Further mineralogical studies yielded 11 more diamonds from the three boreholes.

The De Beers Exploration (Africa) collaboration led Shefa Gems to investigate the potential of Mt. Carmel primary sources more thoroughly between the years 2006 – 2014 (Kalmanovitch, *et al.*, 2008; Toledo, *et al.*, 2010). Simultaneously the large Galed geophysical anomaly identified earlier in the Ramot Menashe area was followed-up with ground surveys (Roup and Fedikow, 2011) and sampling continued in the Kishon River catchment on the secondary deposits.

- At the end of 2009 to early 2010, Shefa Gems set up a comprehensive GIS database to handle the large volume of sample information and spatial data available for its campaign. In addition, Shefa Gems moved to larger premises in Akko (6 000m²) where its treatment facility capacity was increased to handle small bulk samples generated from both primary source rock and secondary alluvial target deposits. Shefa Gems identified a multi-commodity assemblage that included the mineral assemblage the company earmarked as its priority exploration objective. This multi-commodity selection is called the Target Mineral Assemblage (TMA), comprising two mineral suites:

- The dominant (>95%) Gem Box suite of diamond (rare), natural moissanite (largest known grains globally), gem varieties of corundum (notably ruby and sapphire, including a new, to date unique type branded as Carmel Sapphire™) spinel, garnet, ilmenite and hibonite.
- The Heavy Industrial Mineral (HIM) suite: zircon and rutile.

On Mt. Carmel, Shefa Gems explored thirteen of the prominent Mesozoic volcanic bodies/complexes (an additional Mesozoic volcanic body is Umm El-Fahm) for their TMA and KIM's content (Figures 4 & 9). One of the most significant discoveries in this phase was the recovery of abundant moissanite from both primary sources as well as derived secondary deposits, as this mineral is rare in its natural state globally (Roup, *et al.*, 2009; Gnos, 2010; Fritz, 2013). Shefa Gems has also found the world's largest two recorded moissanite crystals: 4.1 mm (Fritz, 2013; GIA, 2015) and 4.14mm (bulk sample 1124, November, 2015) in length respectively.

To confirm Shefa Gems' reports of the recovery of KIM's from primary sources on Mt. Carmel (Israel) during this phase of its exploration campaign in 2011, the Inspector of Mines sent two rock samples from the Bat Shelomo and Rakefet volcanic complex to the SGS Canada Inc. laboratory for processing and recovering KIM's. This laboratory reported the presence of abundant KIM's, but noted that these grains needed to be electron micro-probed (geochemically analysed) before any further conclusions could be drawn regarding any diamond potential (SGS, 2011). However, this additional analysis was not required by the Inspector of Mines, but rather a confirmation that at least two of Mt. Carmel's primary volcanic complexes hosted KIM's as had been reported by Shefa Gems. It must be noted that the use of the term "KIM's" does not have any connotation to the diamond potential – this can only be assessed after the KIM's have been geochemically analysed (mostly using an electron microprobe-type tool). At this stage the Mesozoic Rakefet magmatic (volcanic) complex is the only primary source in the Kishon catchment to have yielded the full TMA suite, as well as the complete range of KIM's (Toledo, *et al.*, 2010).

At Ramot Menashe 149 stream samples were collected to-date that yielded KIM's, corundum, moissanite including eclogitic and peridotitic garnets that have been analysed for their mineral chemistry (396 garnet grains). A further 92 soil samples were processed as part of a geochemical survey (Roup and Fedikow, 2011) and several ground magnetic surveys were run over the Galed anomaly (Rybakov, 2009; Fritz, 2013; GRS, 2014). In the Kishon River catchment, Shefa Gems focused largely on the secondary deposits in the search for alluvial placers that potentially host the complete, or part of, the TMA, preferably Gem Box suite. To date, more than 700 alluvial samples were taken throughout the catchment, 39 trenches and pits were excavated as mini bulk samples, 158 boreholes were drilled to a maximum depth of 300m, state-of-the-art geochemical soil sampling surveys were done, and some 407 grains were analysed for mineral chemistry.

The Kishon River drains considerable parts of Mt. Carmel and the Yizre'el Valley with its Mesozoic mafic and ultra-mafic volcanic rocks, and Cenozoic mafic volcanic rock substrates rendering the Kishon River valley, with its secondary Late Cenozoic valley-fill sediment deposits, a high priority

target. Intensive drilling was done by Shefa Gems in the Kishon Valley, in particular the Mid-Reach section, as shown in Figure 12 & 13.

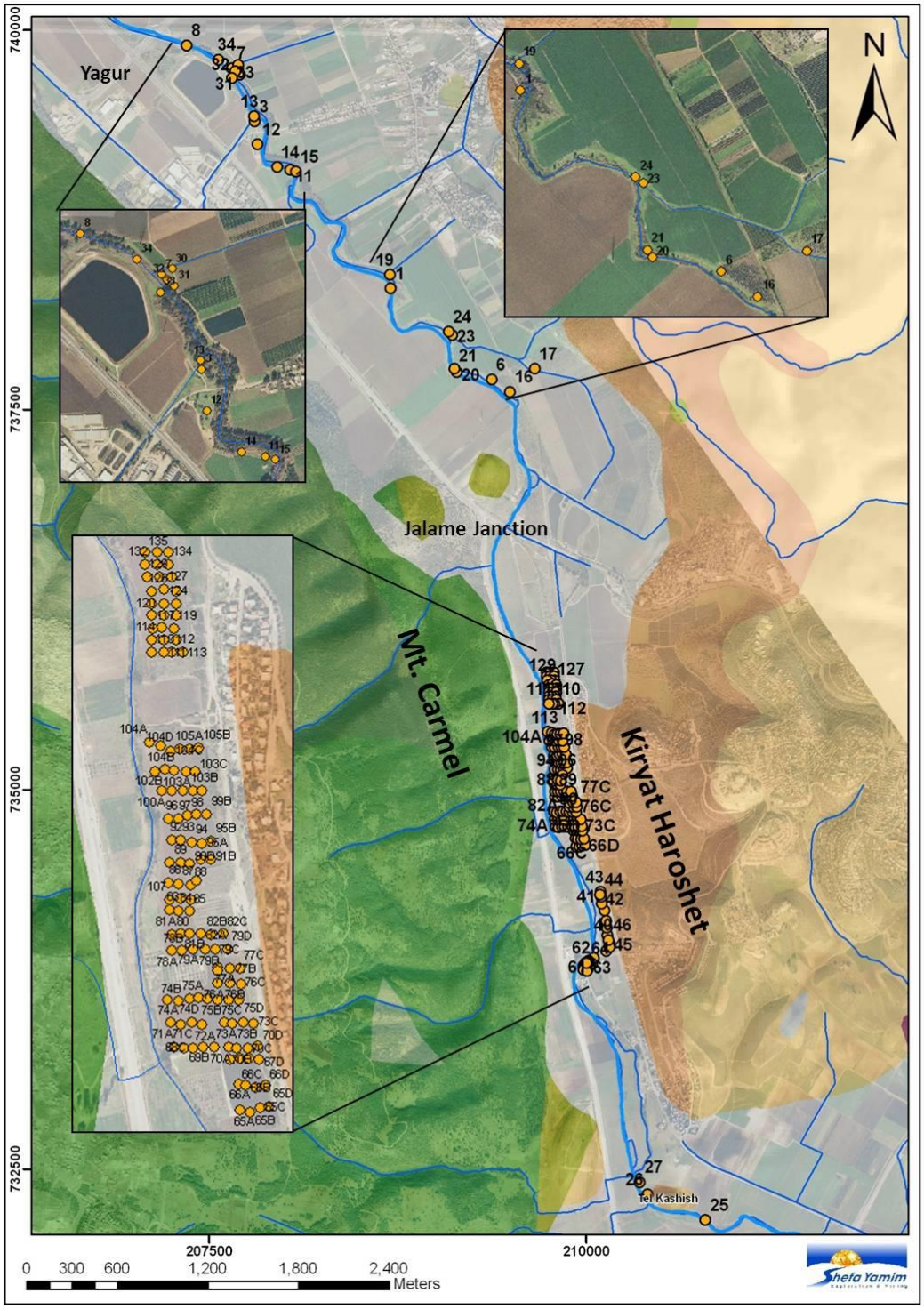


Figure 12: Shefa Gems borehole locations along the Kishon Mid and Distal reaches from Tel Kashish via the Zevulun valley to the Mediterranean outlet. Orange circles - Large diameter (Vidia) Shefa Gems boreholes, down to 80m depth; Yellow circles - 1999-2000 drilling campaign (Vidia) small diameter, including core samplings, down to 300m depth.

Surface and subsurface samples collected from the Mid- and Distal Reaches of the Kishon Valley have yielded significant quantities of the complete TMA (Figure 13). The recovery of moissanite and corundum, including the gem varieties of sapphire (blue, up to 5.72 carats in weight) Carmel

Sapphire™ (up to 33.3 carats in weight), ruby (pink, red up to 1.706 carats in weight) and Hibonite up to 2.83 carat in weight) from the secondary deposits indicate primary sources within the Kishon catchment. Sampling by Shefa Gems has demonstrated that the Rakefet Magmatic (Volcanic) Complex and the tributary stream that cuts through the body are major contributors of both sapphires and rubies to the Kishon River valley sediments.

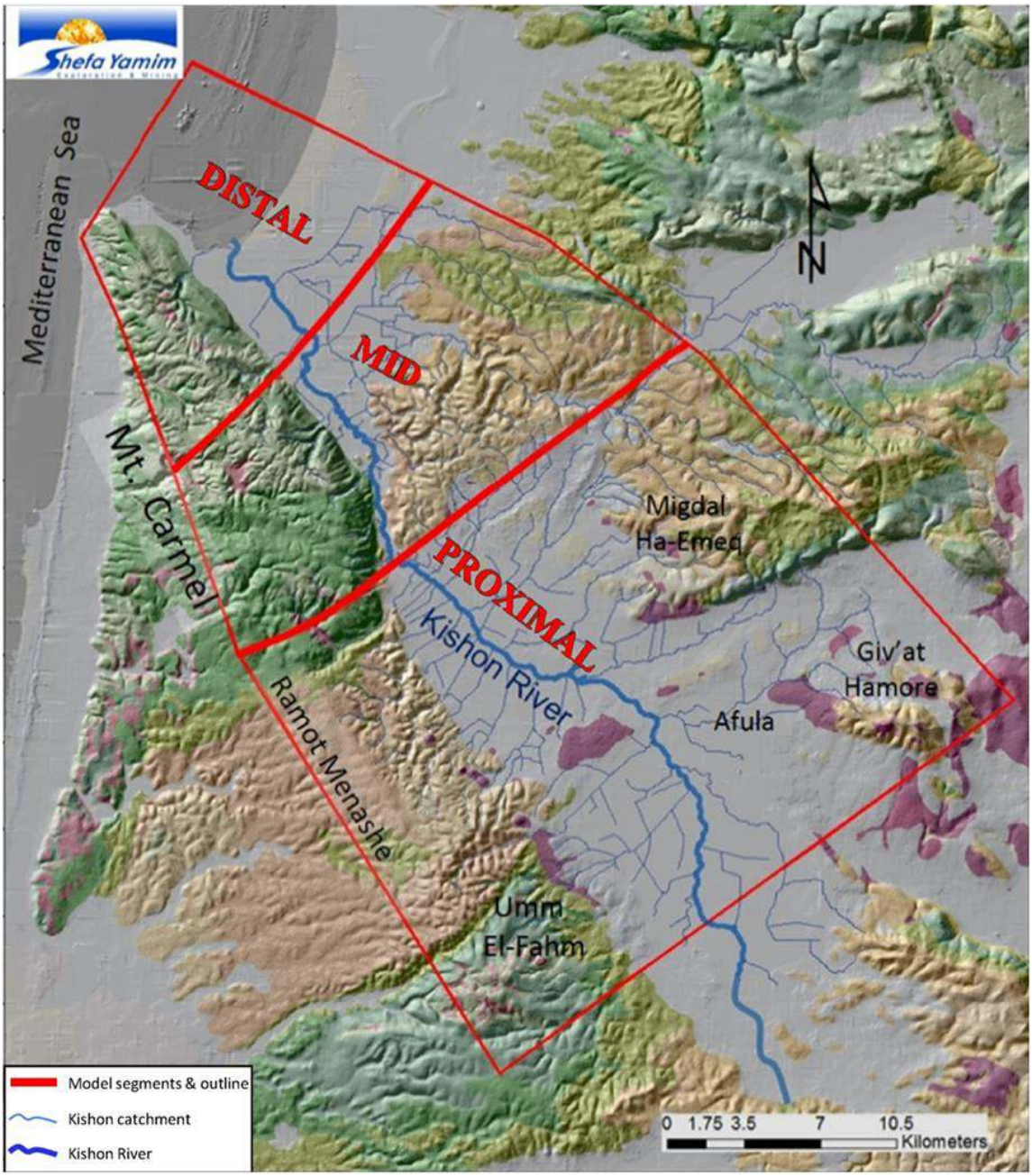


Figure 13: The Kishon River divided into Proximal, Mid-Reach and Distal sections.

Moreover, the exploration results further show that the Mesozoic Muhraka basalts on Mt. Carmel and the younger Cenozoic (Neogene) Lower Basalts and Cover Basalts host corundum, including sapphire and ruby (Wald and Toledo, 2016). Therefore, it is noteworthy that corundum, a relatively common mineral, is linked to alkali basalt terrains globally and that its gem varieties of sapphire and ruby are associated with placers derived from such terrains (Guo, *et al.*, 1996a; 1996b). The high-

pressure upper mantle origin of corundum is also shown by kimberlite-borne, corundum-bearing, eclogite xenoliths and corundum as unusual inclusions in diamonds (Viljoen *et al.*, 1999).

The narrowing of the Kishon Valley between the Yizre'el and Zevulun Valleys facilitated placer formation in the basal gravel beds of the Kishon River in this Mid-Reach zone between Tel Kashish and the Jalame Junction/Turkish Bridge area. Trapping of heavy minerals in these basal gravels deposited under an increased fluvial energy regime is further promoted by the introduction of oversize clasts (Jacob, *et al.*, 2006) from the short-reach, steep streams draining Mt. Carmel along the left bank of the Kishon Valley Mid-Reach.

The heavy minerals are most likely to be preferentially concentrated within the basal 2-4m of the Kishon River gravels. As the Kishon River is a comparatively small-scale hydrological system, with an overburden to basal gravel stripping ratio around 2.5:1, this fluvial placer is readily accessible in contrast to the deeper (>20 m deep), interbedded marine placers farther downstream in the Distal Reach that also host the TMA (in particular the Gem Box suite) (Figure 13 &14).

Therefore, the Mid-Reach of the Kishon Valley, a transient fluvial placer hosted palaeo-Kishon basal gravels preserved in low terraces, flanking the modern course between Tel Kashish and Jalame Junction (Toledo *et al.*, 2015; Toledo *et al.*, 2016), is the most attractive, accessible secondary deposit target available to Shefa Gems in this exploration campaign. This 4.5km long multi-commodity placer contains the TMA which is dominated by the Gem Box suite (>95%) with a minor contribution by the HIM suite (<5%) (Toledo *et al.*, 2015).

During the mapping and drilling campaigns in the Kishon Mid-Reach (146 holes (125 holes in Zone 1 and 21 holes in Zone 2); 1 370.55m drilled in total (1135m in Zone 1 and 235.55 in Zone 2)); a total length of 313m intersected the gravel) two high-interest zones have been modelled volumetrically using ArcGIS®, Voxler®, Strater® and Surfer® software, namely Zone 1 and Zone 2 (Toledo *et al.*, 2016).

External Scientific Collaboration

The unique challenges faced by Shefa Gems in its exploration campaign are emphasized by the unusual occurrence of high temperature and pressure minerals, notably, diamonds, moissanite and corundum in an off-craton platform setting has been highlighted by Coopersmith and Toledo (2013). To unravel the problem posed by these geological challenges Shefa Gems actively strives to get the global geological fraternity involved in its exploration.

Shefa Gems is collaborating with geological and exploration consultants that specialise in a wide spectrum of Earth Science fields e.g. geochemistry, exploration of alluvial deposits, and geophysics. On the primary source investigations, Shefa Gems is collaborating with Prof. Bill Griffin and his research team from Macquarie University, Australia since January 2014. Mr. Dave (David) Apter, ex-De Beers Africa geochemist and currently an independent geological consultant to Shefa Gems, collaborates with the company since 2004. The scientists focus on the presence of mantle-derived

minerals, including garnet (peridotitic and eclogite), clinopyroxene, ilmenite, moissanite and diamond as well as corundum, in the off-craton, rift-related geological setting of northern Israel.

To date Apter (2014, 2015) analysed the mineral chemistry of all the KIM grains that have been SEMQ electron micro-probed from Shefa Gems' exploration campaign, of which 392 grains were done by De Beers Geoscience Centre, Johannesburg, and 2 039 grains by Mineral Services (Pty) Ltd, Cape Town, South Africa. Apter also confirmed the presence of the classic kimberlite indicator mineral suite (KIM) comprising unique chemical varieties of garnet, clinopyroxene, ilmenite, and spinel/chromite in the size range 0.30 - 0.425 - 0.71 - 1.00mm.

The main conclusions were:

- The CPX xenocrysts from the Mt. Carmel volcanics show a geothermal profile for lherzolitic mantle stretching from ~Moho depths (<50km) to well over 100km: see Temp * Depth/Pressure plots.
- Re-fertilisation/depletion - bottom-left to top-right gives increasing depletion along a relatively constant pressure.
- The data illustrates a complex relationship between temperature/composition with pressure/depth. An increase in heat flow with decreasing pressure/depth is observed using Hasterok and Chapman (2011) geothermal models.
- The improved data resolution reveals a small, but relatively high-pressure population of significant interest. This relatively small deeper/cooler population from RMC is more like 'kimberlitic' CPX. With a depth >100km this population is more typical of thick cratonic 'kimberlite' borne CPX xenocrysts. This limited, but deepest, Mt. Carmel CPX population is represented by a 'range' in composition with deepest grains more re-fertilised by the underlying asthenospheric mantle (fluids/magma). However, such asthenospheric 'alteration/re-fertilisation' has influenced the entire mantle column. Fluid interaction across the column may be responsible for multiple mantle magma sources.
- A mantle derived population that reflects high T at shallower levels due to high heat flow: the potential source for shallow xenoliths as reported by Mittlefehldt (1986) and Kaminchilk (2014).
- Improved insights from the Na*Cr + Al diagram show this compositional relationship is consistent with pressure. This observation enhances the value of this diagram in diamond exploration where ultra-high pressure and low re-fertilisation CPX indicate best potential for GP-hosted diamonds. That is where CPX data points show highest pressures with least re-fertilisation (i.e. diagram top-right; increasing pressure (isobars) from bottom-right to top-left; re-fertilisation from top-right to bottom-left along isobars).

From these results, Apter (2014) and Apter *et al.* (2015), concurred with Mittlefehldt (1986) on the Mesozoic mafic and ultra-mafic bodies on Mt. Carmel had sampled xenoliths / xenocrysts in the upper mantle and lower crust between depths of 60 – 110km. In a recent study, however, Kaminchilk (2014)

obtained results from a limited suite of xenoliths that pointed to even shallower depths of around 45km.

Shefa Gems also collaborates with Prof. Bill Griffin, an expert in Earth's mantle geology and his research team on corundum crystallisation processes and their relationship with the natural, rare mineral moissanite occurrences. Samples for this research have been drawn from several primary sources on Mt. Carmel and from alluvial deposits within the Kishon Catchment. The results of this continuing research may assist in addressing key questions regarding "Deep Earth" geology. A poster and abstract focusing on this topic were presented at the Israeli Geological Society Conference, March 2015 and January 2016 (Griffin *et al.,* 2015; Griffin *et al*., 2016.)

Carmel Sapphire™

Prof. Griffin contacted Shefa Gems in January 2014 in search for moissanite crystals to be included in a survey of Si and C isotopes in this mineral, mainly using material from kimberlites. Shefa Gems kindly provided the material needed. Apart from moissanite crystals, Shefa Gems shipped samples of sapphire, ruby and corundum as well. An ongoing exciting and productive collaboration has been ongoing ever since. At the beginning, the target was to better define the corundum-moissanite findings provenance – or rather is there a genetic connection between the two minerals occurrences? The ongoing research provides some great scientific results including unique large corundum stones (up to 33.3ct) whose polished specimen revealed that they in fact have unique qualities and considerable potential as gemstones. These unusual corundums have been called, and trademarked, as Carmel Sapphire™.

> "… Therefore, we have suggested that the titanium-rich corundum should rather be designated Carmel Sapphire™, since it is unlike gem-corundum known from elsewhere in the world". Prof. Griffin, January 21, 2016.

As Carmel Sapphire™ makes up a large portion of the material recovered from the samples, this finding implies a significant increase in the value of the resource. According to the research findings, the corundum evolves from oxygen depleted zones within the upper mantle (Griffin, 2016). Prof Griffin and his team's ongoing research on the samples from the Kishon River valley, RMC and Migdal Ha-Emeq led to the discovery of yet another gemstone, the very rare gem hibonite as reported in October 2016.

Abundant moissanite in Cretaceous pyroclastic rocks in northern Israel is accompanied by xenoliths and xenocrysts of skeletal and hopper-structured corundum crystals, which have trapped pockets of the melts from which they grew. The melts contain highly reduced mineral assemblages, including native elements such as Ti and V; these imply fO_2 (fugacity values) as low as IW-12. Detailed study of this material suggests it crystallised due to interaction (reduction and desilication) between mafic-ultramafic magmas and highly reducing fluids. Such fluids can be derived from the deep Earth, since C-O-H fluids at the fO_2 of the IW buffer are completely dominated by CH_4+H_2.

The rare presence of diamonds, along with an abundance of the two other high-pressure minerals, moissanite and corundum (including sapphire and ruby), in several Mesozoic primary sources on Mt. Carmel and in the Cenozoic Kishon Valley secondary deposits, points to an unusual, off-craton geological history that continues to warrant further exploration and scientific explanation.

Likewise, the presence of corundum in both Mesozoic mafic and ultra-mafic volcanics and younger Cenozoic mafic volcanics supports the potential for sapphire dominant (and to a lesser extent, ruby) placers to have been developed along the Kishon Valley, especially corundum in volcanic sources (Guo *et al.*, 1996) in the Mid-Reach zone between the Yizre'el and Zevulun Valleys (Figure 4).

Consequently, and incorporating the available geological mapping (Sneh *et al.,* 1998; Segev and Sass, 2009a, 2009b), a robust "source to sink" geological model (Figure 14) has been developed to guide placer exploration in the Kishon catchment. This model also serves to highlight opportunities for further investigation into the primary sources within this catchment and in the adjacent areas of Mt. Carmel, Ramot Menashe and Migdal Ha-Emeq (Toledo, *et al.*, 2014; Figure 14). The Kishon drainage has been subdivided into three geomorphic reaches along its length that covers the Exploration Permit and Prospecting Permits held by Shefa Gems, namely: Proximal Reach, Mid-Reach and Distal Reach (Figures 13 & 14). Each reach has varying degrees of placer potential that represents the potential for both Cenozoic placer formation and for primary source inputs from the Mesozoic and Cenozoic volcanic rock types within the Kishon catchment.

Proximal Reach: Upstream from Tel Kashish where the Kishon and its tributaries are relatively unconfined, tributaries and alluvial fans are small and therefore placer development is limited.

Mid-Reach: Between Tel Kashish and the Jalame Junction (Turkish Bridge) where the Kishon Valley is most confined and narrow, conditions for placer development are optimal and further assisted by the input of oversize clasts from steep tributaries draining Mt. Carmel.

Distal Reach: From Jalame Junction (Turkish Bridge) down to the Mediterranean Sea in the Bay of Haifa. This section incorporates the Kishon graben that hosts interbedded marine units of the palaeo-Haifa Bay. Best placer development due to upgrading through marine reworking, but inaccessible due to deep burial in the Kishon graben.

- Gemstones from primary sources discovered in some volcanic bodies within the Kishon catchment, notably Diamond (D), Sapphire (C), Carmel Sapphire™ (C), Ruby (C), Moissanite (M) and Hibonite (H) which formed the original DMCH suite to which spinel, garnet and ilmenite were added to give the Gem Box suite.
- Gemstones are transported via the Kishon River from sources to a sink in the Mediterranean Sea

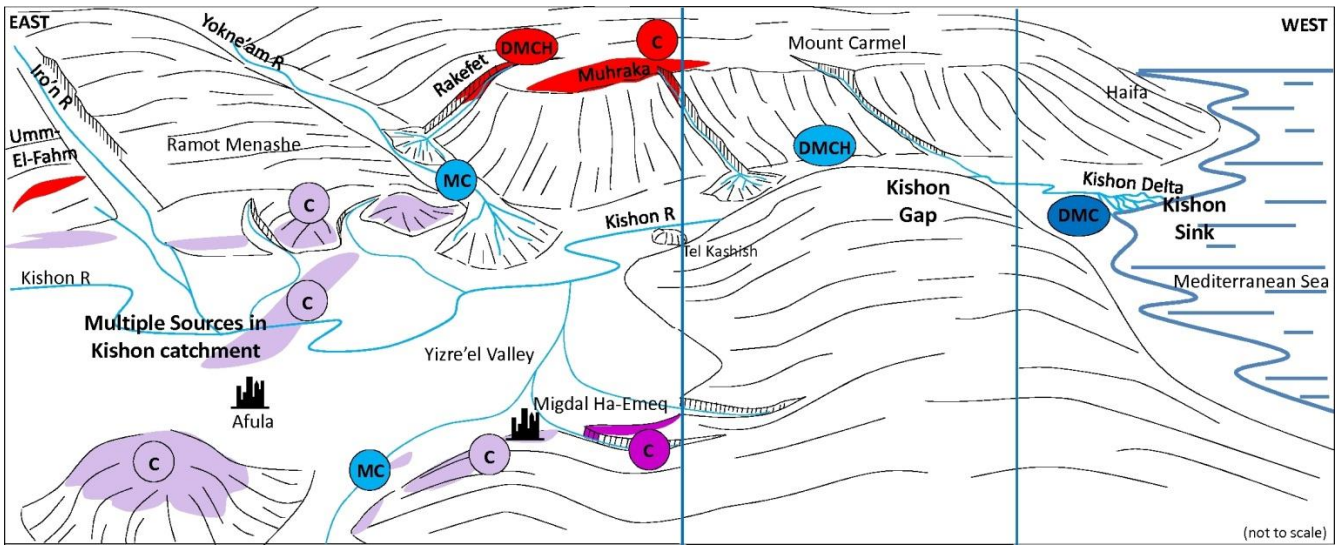


Figure 14: Schematic diagram showing the "Source to Sink" geological model guides to locate deposits of Gemstones. View approximately south and not to scale (from Toledo, *et al.*, 2014). To be read in conjunction with Figure 13 above.

- The placer deposits in the sink are deeply buried and difficult to access
- The most accessible natural trap for the gemstones is in the Mid-Reach area of the Kishon Valley where the river is confined through the "Kishon Gap" to form a transient placer
- The Kishon Mid-Reach deposit has good concentrations of spinel, garnet, ilmenite, Carmel Sapphire™, Sapphire, Ruby and Moissanite with reasonable prospects of eventual economic extraction (SAMREC, 2016)

9. History

9.1. Historical Ownership

Shefa Gems was the first and only exploration company that registered prospecting and exploration rights and conducted systematic exploration for diamonds, precious stones and gold over the Kishon River valley, the volcanic bodies on Mount Carmel, as well as the Zevulun and Yizre'el valleys in northern Israel.

9.2. Historical Activities

The only documented historical exploration in the area is work done by Shefa Gems since its inception in 1999 (as Shefa Yamim (A.T.M.) Ltd.). Prior to the first Prospecting License Right granted to Shefa Gems in 2018, historical activities comprised surveying of the volcanic complexes on Mt Carmel by means of mapping, geophysical surveys, petrographic and geochemical studies, kimberlitic indicator mineral analysis and bulk sampling. Exploration work in the Kishon River Valley consisted of an orientation drilling programme along the valley axis covering the entire valley from just below the headwaters to the distal estuarine part of the flood plain. The orientation drilling was followed by high density infill drilling with the main focus on the Mid-Reach section of the Kishon Valley.

The drilling campaign was followed by an intensive bulk sampling programme covering Zone 1 and Zone 2 in the Mid – Reach of the Kishon River Valley. This programme is still ongoing with several samples still to be processed.

No historical mining activities have been conducted on the Shefa Gems permits and licence areas.

9.3. Historical Exploration and Data Collection

9.3.1 Introduction

Shefa Gems' exploration and prospecting programme commenced in 1999. The company adopted a systematic milestone-based exploration strategy. In doing so, confidence in results are improved by constructing the programmes so that these support a continuum of decisions based on results obtained, and risks and uncertainties are reduced as the exploration programmes advance.

Conventional exploration techniques are applied that include:

- Regional and detailed geological mapping in target areas identified by remote sensing.
- Ground geophysical surveys using gravity and magnetic techniques.
- Geochemical surveys using the Metal Mobile Ion (MMI) method.
- Petrographic, mineral chemistry and whole-rock geochemical analyses. These analyses are conducted at accredited laboratories and universities.
- Reconnaissance and small-scale sampling of alluvial deposits (stream deposits) and *in situ* volcanic rock.
- Small and large diameter (up to 1m) boreholes.
- Pit and bulk sampling.

9.3.2 Geological Mapping

The volcanic bodies of Mt. Carmel had been mapped on a regional scale in the past, however, the volcanic complexes have not been mapped in detail as individual bodies. To conduct a detailed mapping programme, Shefa Gems verified the nature and continuity of these volcanic bodies on Mt. Carmel. Subsequently it has been demonstrated by Shefa Gems that the Kishon Valley yields diamonds, natural moissanite and gem corundum (original DMC suite) as well as volcanic-related Kimberlitic Indicator Minerals (KIMs). The primary source of these minerals had to be identified. A programme was designed and implemented to ascertain which of the intrusions on Mt. Carmel have the better TMA (in particular the Gem Box suite) potential, and are the most likely sources of these minerals in the Kishon Valley.

Geological mapping and verification of previous mapping was performed by Shefa Gems in various areas across the permit areas. Specific areas in the volcanic bodies were surveyed to validate previous mapping campaigns, using photo geology, field mapping and remote sensing. The exploration target of the Mid-Reach had hitherto not been mapped. Shefa Gems used the maps of the slopes that

border it from the west and east of Mt. Carmel (Atlit sheet: Segev and Sass, 2009) and Tiv'on Hills respectively to assist in the mapping of the Mid-Reach part of the valley. Shefa Gems 3D geological modelling of this transient alluvial placer is based on borehole logging data, complimented by geological and structural mapping data from limited outcrops along the valley slopes.

9.3.3 Geophysics

All Target areas and their surroundings are surveyed by various geophysical methods that included: spectral analyses by means of multi-band Aster imagery (remote sensing); Time Domain Electro-Magnetics (TDEM); GAP (Ground Acoustic Penetration); and Ground Magnetics (MAG) surveys.

9.3.4 Geochemical Surveys

Volcanic bodies and their eroded, alluvial products are the primary focus of the geochemistry analyses. Comprehensive geochemical analyses are routinely carried out using a Scanning Electron Microprobe Quantometer (SEMQ), scanning electron microscope (SEM) and X-Ray Diffraction (XRD) along with other techniques.

Shefa Gems collaborates with several academic institutions in unravelling the nature of the volcanic bodies on Mt. Carmel and surroundings to assist in exploration target prioritisation. Of these, the Macquarie University in Australia has been, and still is, engaged since early 2014 in the study of mineral assemblages found within Shefa Gems' permit areas. The study is led by Professor Bill Griffin, an expert in the Earth's mantle geology. His team is currently examining moissanites, sapphires, rubies, and Carmel Sapphire™ minerals sampled from Mt. Carmel volcanic bodies, and the alluvial placer minerals within the Kishon valley.

The results point to an unusual provenance, indicating a complex geological history prior to the erosion and placer accumulation of these minerals. The geochemical evidence with reference to the Mt. Carmel volcanic bodies indicates a deep and high temperature magma source for the minerals. The results obtained here contributed generously to the understanding of the prevailing geological conditions at Mt. Carmel and of Israel and the Levant region in general.

9.3.5 Drilling

9.3.5.1 Introduction

Shefa Gems has drilled a total of 186 boreholes to date. Borehole diameters range from 0.063 – 1.0m and the maximum depth drilled was 300m. Drilling started in 1999 and is still on-going in accordance with the company's work programme. The geographical extent of the drilled area generally follows a northwest to southeast trend that is from the distal reach of the Kishon catchment upstream.

9.3.5.2 Drill holes in the Distal Reach

During the period 1999 to 2000, a total of ten, 300m deep boreholes were drilled, spaced over 8km along the down-valley profile of the lower reaches of the Kishon River Valley, the Distal Reach (Figure 15). Drilling was done using a 63mm diameter rotary drill. The core revealed abundant KIMs, while a total of 64 diamonds (63 micro-diamonds of 0.12ct in total and one 0.88ct stone) was recovered from these drill holes.

During the period November 2004 to December 2004, three, 1m diameter auger boreholes were drilled in the section that produced the most favourable results during the 1st drilling phase. Further mineralogical studies in the Distal Reach of the Kishon River yielded 11 more diamonds from the three boreholes.

9.3.5.3 Drill holes in the Area between the Distal and Mid-Reaches

Further upstream (between Yagur and Jalame) seven more holes were drilled to shallower depths (SY-11 to SY-17), also recovering TMA occurrences (Figure 15). The heavy and indicator minerals recovered the full TMA including the DMC suite and HIM suite. Other minerals present are amphibole, kyanite, magnetite, hematite, pyrite, limonite, spinel, olivine and barite (Kalmanovich, *et al*., 2008).

A borehole SY-18, drilled in the Kiryat Haroshet area during 2008, yielded the complete TMA suite of minerals, including one micro-diamond. Shefa Gems progressed to the southern part of the Mid-Reach and added two closely-spaced holes near borehole SY-18, namely SY-28 and SY-29.

9.3.5.4 Drilling in the Kishon River Mid-Reach target: Tel Kashish - Jalame Junction

The Mid-Reach of the Kishon River is flanked by lower terraces that occupy the floodplain in this narrow valley section. Since 2013 the Mid-Reach area became the focus of attention and is currently explored by on-going drilling and bulk sampling across various target areas. Two main exploration targets on its right bank yielded relatively high concentrations of TMA including Gem Box minerals (except diamond) and HIM suites from drill core and are located on both sides of the large (800m wide) Kali'a River alluvial fan. The area was divided into two sub-zones comprising a northern target area that was termed "Zone 1" and the southern target area termed "Zone 2" (Figure 16 and 17).

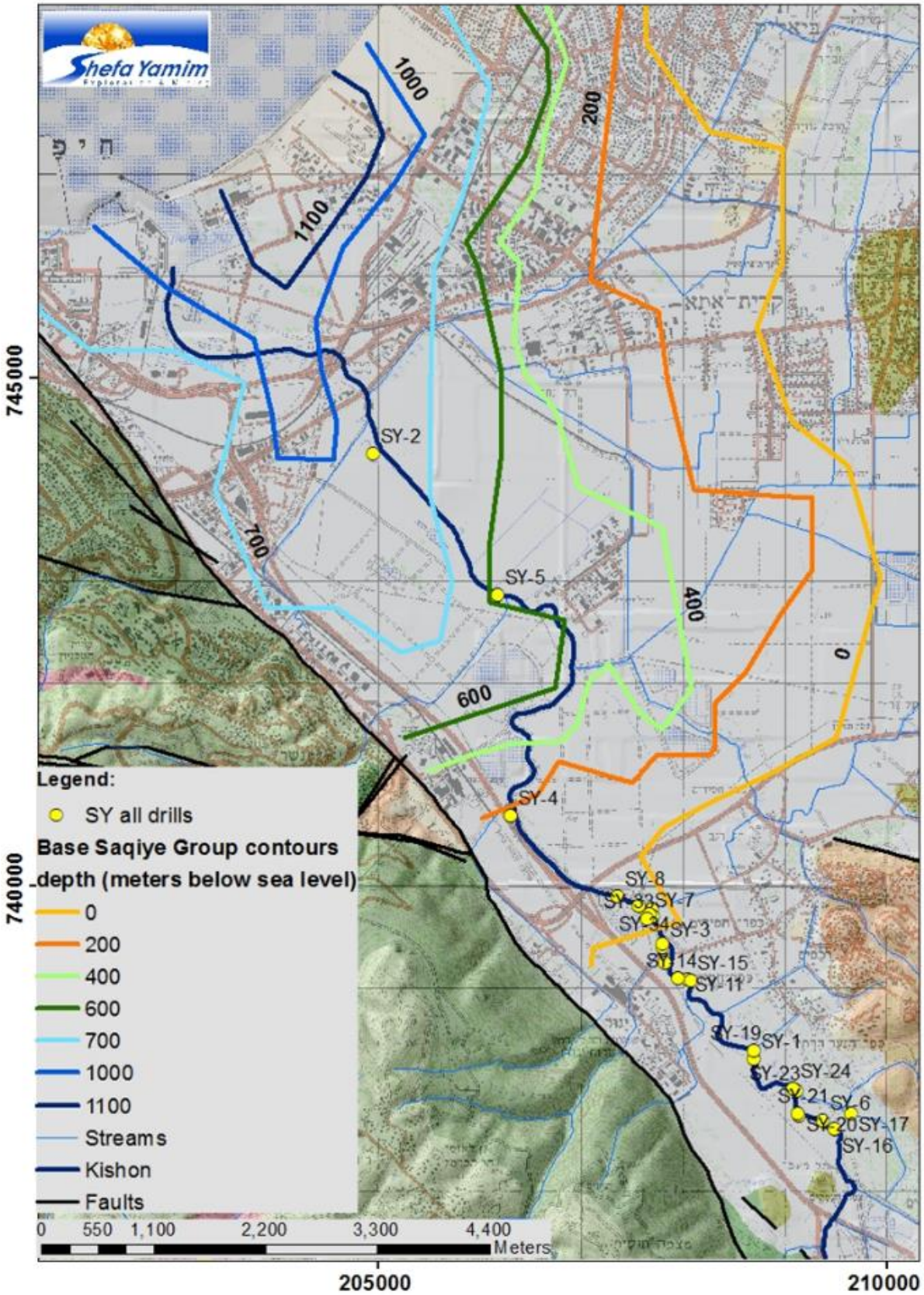


Figure 15: Location map for Shefa Gems' boreholes (1st Phase) across the Distal Reach of the Kishon Valley from Jalame Junction (Turkish Bridge) to the Mediterranean coastline (Haifa Bay). Coloured contours show the base of the Saqiye Formation horizon, in meters below surface.

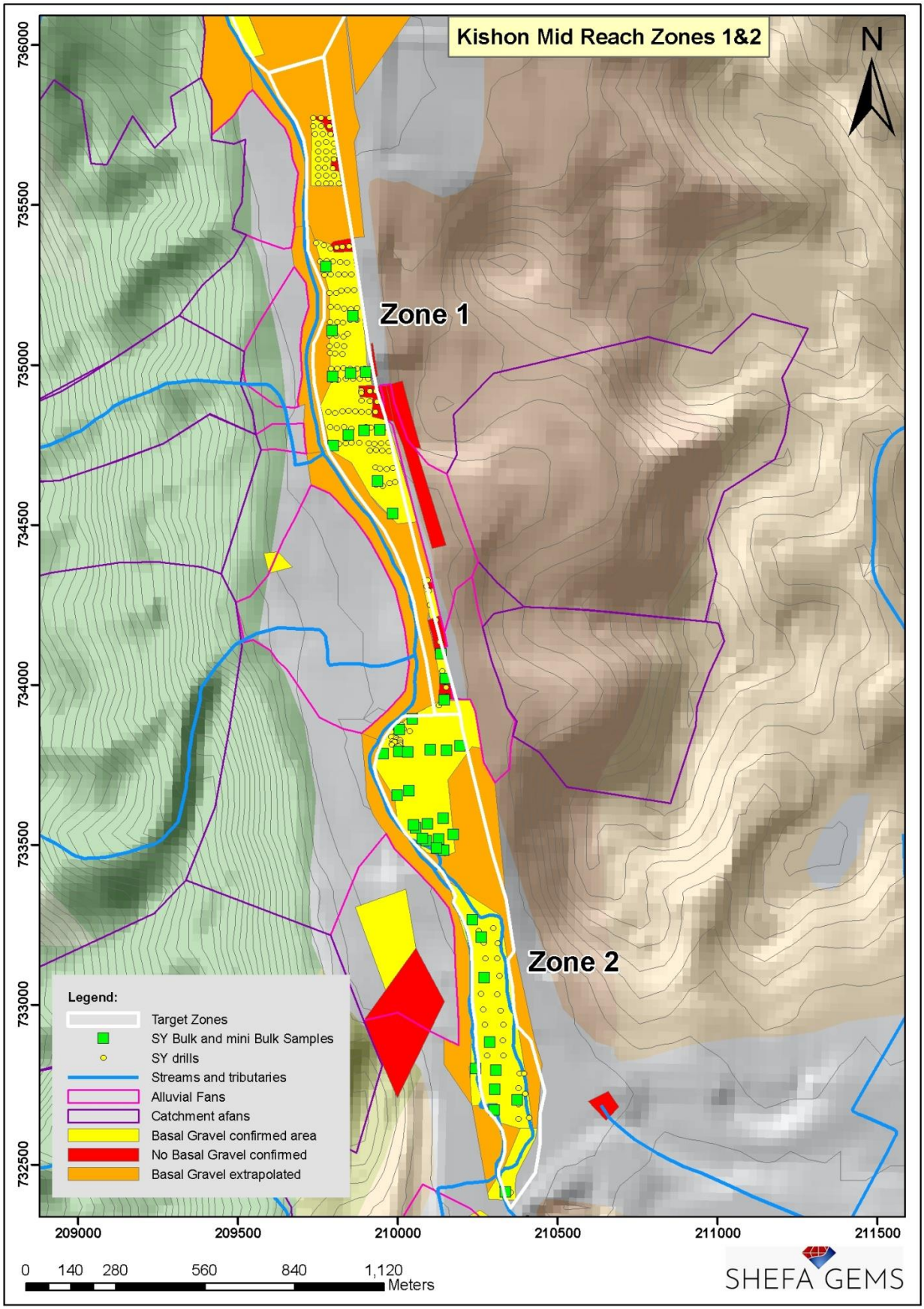


Figure 16: Location map for Shefa Gems' Mid-Reach model from Jalame Junction (Turkish Bridge) to Tel Kashish including alluvial fans (pink outline), their correlative catchment areas (purple), and gravel occurrence polygons (yellow). Note that Zones 1 and 2 incorporate the largest alluvial fan from both sides.

Shefa Gems SY-35 to SY-64 Drilling Campaign (Zone 2; October 2013)

A large diameter (70cm) drilling campaign commenced in 2013 with 30 boreholes (borehole numbers SY-35 to SY-64) drilled to a maximum depth of 26m. The drill samples were treated and processed at the Shefa Gems' processing facility and laboratory at Akko.

This Mid-Reach drilling campaign SY-35 to SY-64 (Zone 2) could be divided into 2 geographic sectors. The northern sector includes boreholes SY-35 to SY-46 (and the southern sector includes holes SY-47 to SY-64 (Figure 23).

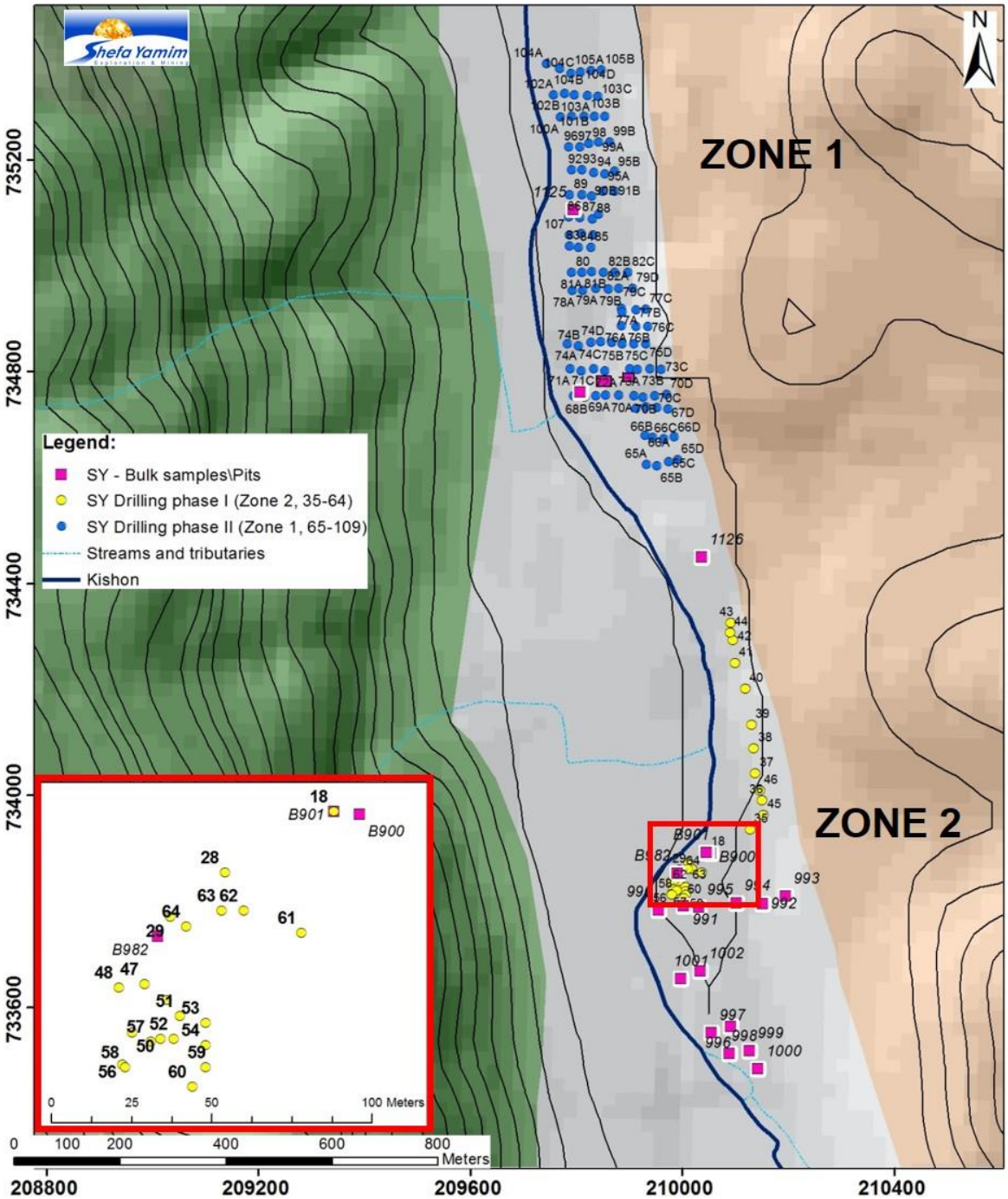


Figure 17: Borehole and bulk sample locations in the Mid-Reach- Zones 1 & 2 (target areas). Enlargement of Zone 2 is shown in the left-hand corner.

Shefa Gems SY-65 to SY-109 Drilling Campaign (Zone 1; May-June 2014)

A detailed and closely-spaced drilling campaign was done during May - June 2014 with a total of 97 new boreholes being drilled to a maximum depth of 16m; each borehole yielded TMA minerals. Drilling commenced with a diameter of 0.7m, but from borehole SY-80 onwards, the diameter was enlarged to 1m. The boreholes cover an area of 800m x 120m with an average gravel thickness of 4m. Only the targeted gravel beds were sampled.

Shefa Gems SY-110 to SY-137 Drilling Campaign (Zone 1; July 2016)

A further 28 boreholes were drilled (pile Vidia drilling) in the distal portion of Zone 1 of the Kishon Mid-Reach placer in July 2016 (Figure 18 & Figure 19). The diameter of these auger holes was 0.5m and average drillhole depth was 11.5m. Holes were spaced at mostly 3 holes per line. The drillhole cuttings were then amalgamated per line into 9 composite samples, averaging 6.7 ton each.

Figure 18: Drillholes SY-110 to SY-137 (Diameter = 0.5 m) drilled in distal Zone 1, July 2016.

The overburden cover ranged from about 3.5 to 7m, with the average gravel thickness being 3.5m, except for the most distal holes where it drops to about 1m. The samples tested positive for the

presence of gemstones and heavy industrial minerals, except for diamonds. Carmel Sapphire™ was the most abundant gemstone mineral. The furthest downstream drill line, notably drillholes SY-134, SY-135, SY-136 and SY-137, marks the transition from the more confined Zone 1 that hosts thicker placer gravels into the wider, more open palaeo-Kishon Valley of Zone 3 in the Jalame Junction area that hosts thinner placer gravels with thicker overburden.

9.3.5.5 General Stratigraphy of the Mid-Reach Fluvial and Alluvial Sediments

The overall stratigraphy from bottom to top includes three main units: bedrock, gravel and sandy-clay overburden. However, the alluvial section is complex with limited to no continuity, local lenses, intercalations and lateral sub-unit shifts are portrayed. Generally, the bedrock unit is a carbonate substrate of chalk to marly chalk, at places cherty chalk or limey chalk. Overlying the chalk is a mixed layer of bedrock-derived gravel and gravel that cannot be differentiated easily. This unit was mostly water-logged and gritty (groundwater level was reached while drilling). Its general colour is grey-brown.

Overlying the mixed layer, a basal gravel bed is found in most of the drilled area. This bed rests directly on the bedrock and is assumed to represent palaeo-Kishon basal gravels. Gravel pebbles, cobbles and boulders are in the range of 4 - 700mm, with minimal grit in the 2 - 4mm fraction.

Overlying the basal gravel is the overburden clays and sandy clays of this fining-upward sequence and ultimately the uppermost level of which is affected by soil processes (pedogenesis). Local clayey lenses are found across the gravel beds, dividing them into basal (lower) and suspended (upper) sub-units.

9.3.6. Bulk Sampling

9.3.6.1 Introduction

The bulk sampling programme part of the exploration has been performed in various target areas throughout the permit area. Of special significance are the (1) volcanic body at the RMC and headwater streams that drain the RMC and (2) the Mid-Reach of the Kishon River (Zones 1 & 2). A total of 46 pit and bulk samples was sampled up to the end of 2017.

Initially, bulk sampling focused on the magmatic rocks on Mt. Carmel, where a total of 10 bulk samples were extracted from pits along the Rakefet-Yoqneam drainage system. However, with the appreciation of the extent of placer formation taking place in the drainage systems receiving eroded material from Mt. Carmel led Shefa Gems to extend the bulk sampling programme further to the north to the more distal reaches of the Kishon catchment. This was focused in particular just down-valley from the extensive alluvial fan deposits at the foot of Mt. Carmel. Here the main focus is on the Mid-Reach section of the Kishon River floodplain and down-valley from the RMC tributary confluence with the Kishon River.

The alluvial bulk samples were collected from short trenches excavated approximately perpendicular to the palaeo-flow direction of the ancient Kishon course preserved in low terraces flanking the modern course. These bulk sample trenches, some 20 - 30m long by 4 - 5m wide, were excavated down to the bedrock (footwall) contact through a total sediment thickness of some 6 - 8 m, of which the basal target gravels comprise some 1 - 4m. Some 400 – 500t of carbonate-dominated coarse basal gravels is removed to the dedicated treatment facility operated by Shefa Gems in Akko where the sample is scrubbed, screened (bottom screen size is 1mm), jigged to concentrate the heavy minerals which are then hand-picked in a secure laboratory by trained personnel. All sample concentrates are kept for audit purposes and the basal gravel tailings are returned to the bulk sample trench for rehabilitation.

Shefa Gems has sampled five (5) pits excavated by outside contractors and operators. The gravel component in each test pit was excavated with the necessary care and transported to Shefa Gems' operational site in Akko for treatment.

The five samples are:
BS-1137: 100t, Jalame Junction water pipe installation facility.
BS-1126: 90t, Mid-Reach of Kishon River near holes SY-65 – SY-109.
BS-1128: 30t, P.E.I. pipe installation facility.
BS_1129: 120t, P.E.I. pipe installation facility.
BS-: 150t, I.E.C. construction pit.

9.3.6.2 Bulk Sampling in the Kishon River Mid-Reach Target: Tel Kashish - Jalame Junction

The Mid-Reach of the Kishon River from Jalame Junction to Tel Kashish extends over a distance of 4.5km. Prioritisation of exploration targets led to a division of this area into 4 main segments, from north to south (A-B-C-D). These segments were selected based on mineral recovery during the drilling campaign and general geological and morphological considerations. Areas B and C correspond to target Zones 1 and 2.

Shefa Gems has done closely-spaced exploration pit sampling (10 – 600t samples) in two key areas namely near bulk sample 982 (Figure 17) (Kiryat Haroshet; Zone 2) and near boreholes SY-65 to SY-109 (Zone 1). Some of the more prominent samples excavated and treated are discussed in detail below.

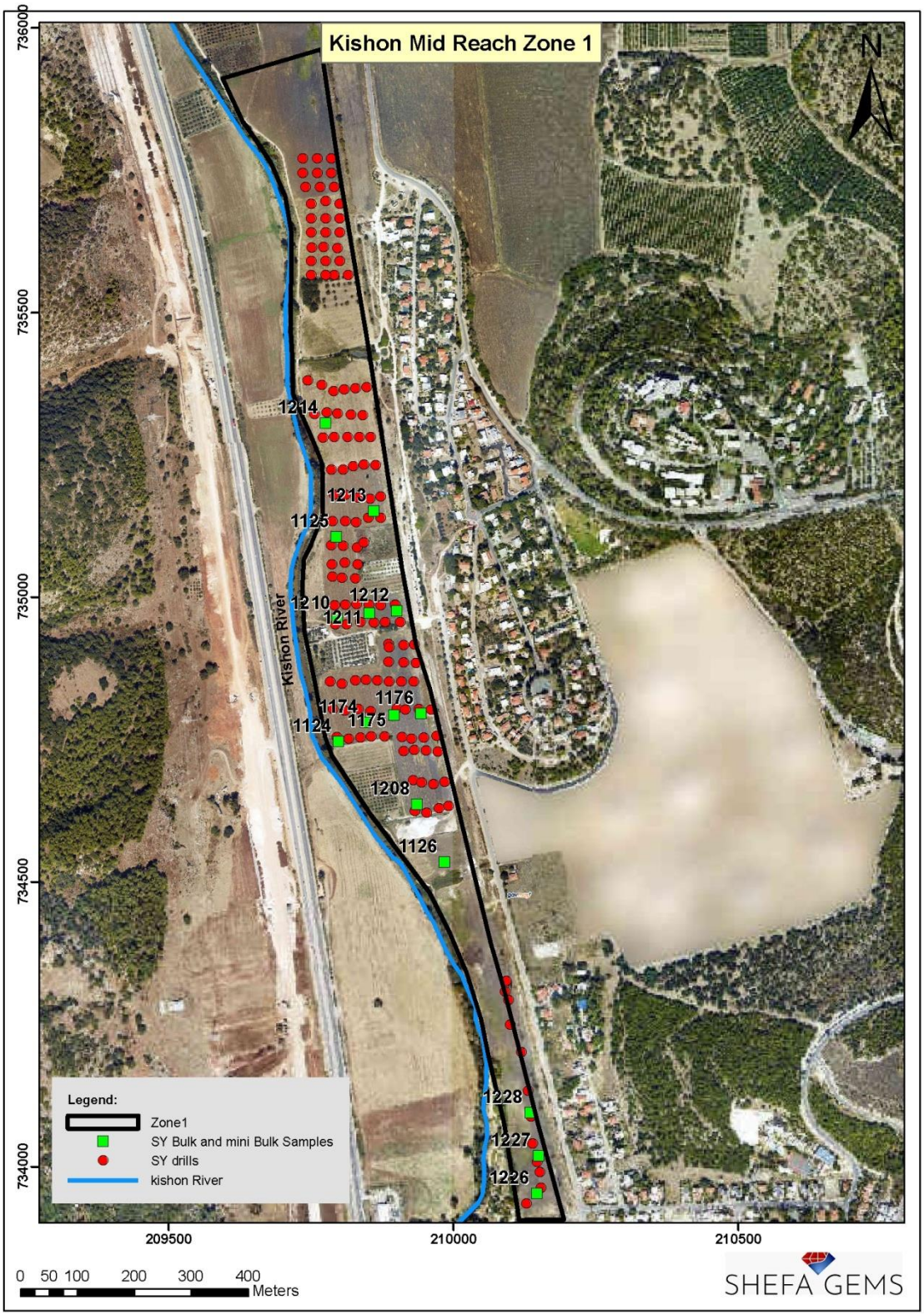


Figure 19: Borehole locations and bulk sample positions in the Zone 1 of the Mid-Reach.

9.3.6.2.1 Bulk sampling in Zone 1 (SY-65 to SY-109 area)

Bulk sampling locations were chosen based on: positive TMA results in boreholes; relatively thick gravel layers of 3 – 5m thick; and increasing thickness trends shown by the geological cross sections.

Fourteen bulk samples, BS-1124, BS-1125, BS-1174, BS-1175, BS-1176, BS-1208, BS-1211, BS-1210, BS-1213, BS-1214, BS-1126, BS-1228, BS-1227 and BS-1226 were excavated in Zone 1.

Bulk sample BS-1124

Bulk sample BS-1124 was taken at a location just north of boreholes SY-68A and SY- 68B (Figure 19; Figure 20). A total of 400t gravel was sampled here during August 24 - 25, 2014.

The general stratigraphy from bottom to top includes three main units: bedrock, gravel and a clayey overburden. The internal structure of the gravel is, however, complex, with local lenses, intercalations and lateral sub-unit shifts. Generally, the valley floor bedrock unit is a carbonate bedrock of chalk to marly chalk, at places cherty chalk or limy chalk. Overlying the chalk is a mixed layer of bedrock derived material and gravel, which, to an extent, cannot be differentiated. This unit is predominantly water-logged. Its general colour is grey-brown.

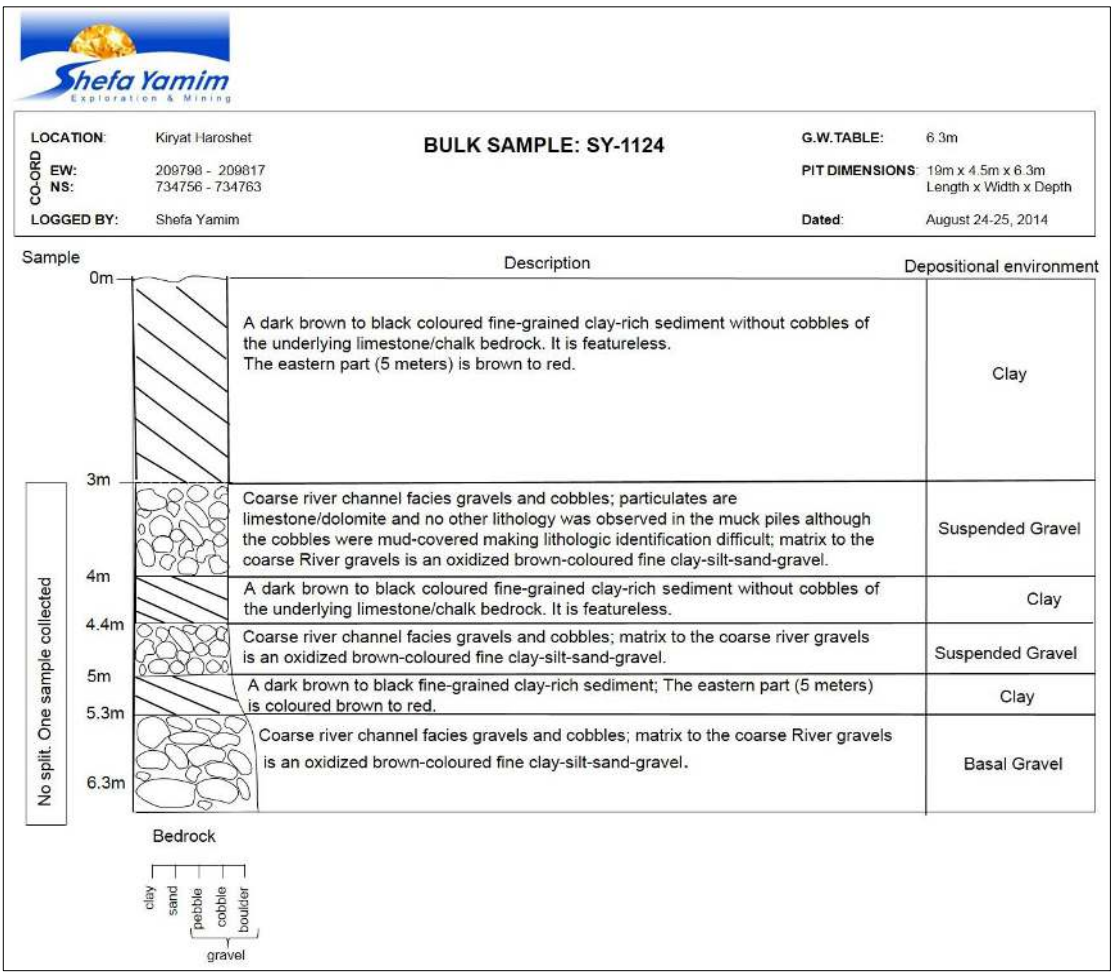


Figure 20: Trench-wall stratigraphy of bulk sample BS-1124.

Overlying the mixed layer is a basal gravel bed comprising rounded to well-rounded gravel in the pebble to boulder size range. Boulders of up to 70cm in diameter are found. Overlying the basal gravel is dark-brown clayey overburden material. Clayey lenses are found throughout the gravel beds, dividing them into basal (lower) and suspended (upper) subunits (Figures 20 & 21).

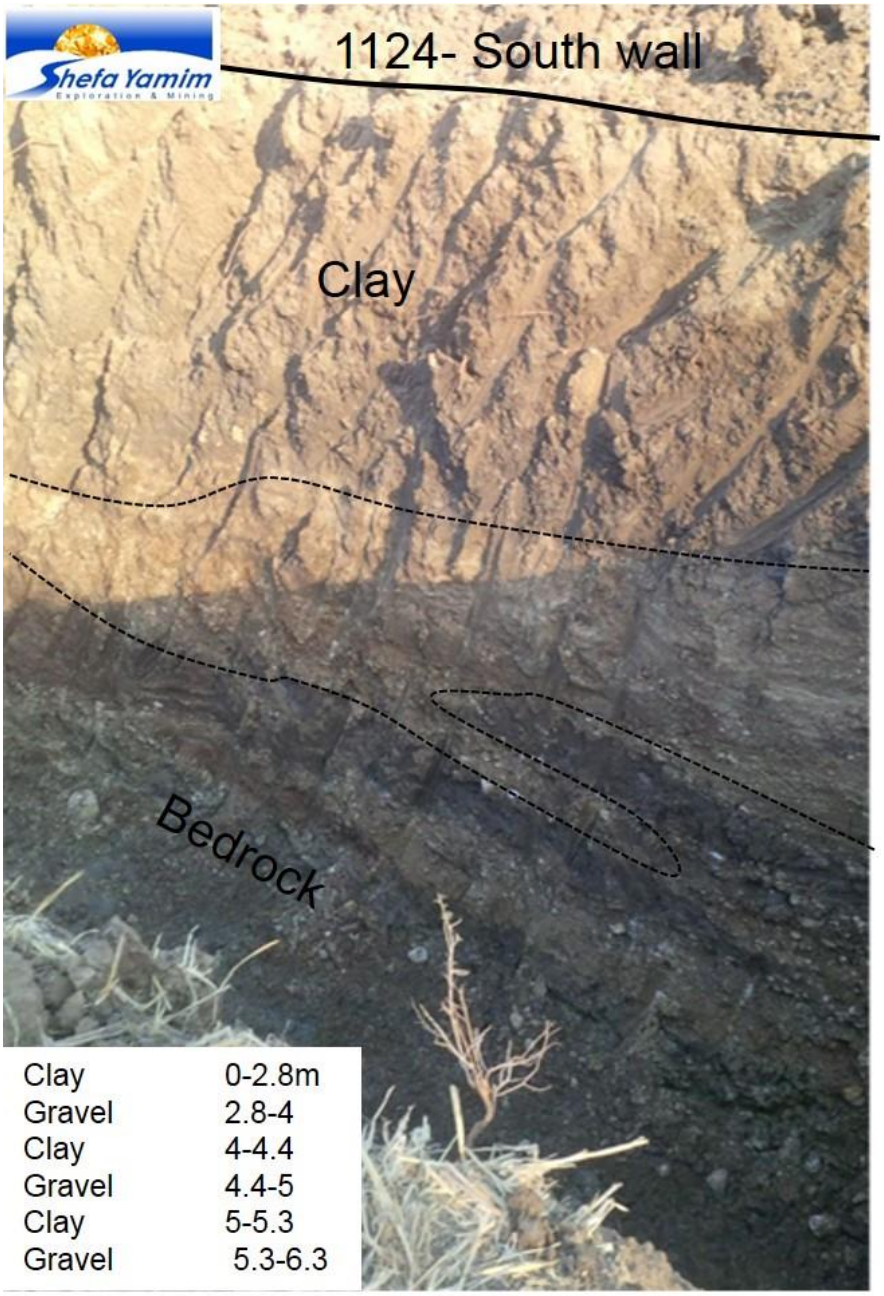


Figure 21: The southern wall of bulk sample BS-1124. Note two interbedded clayey lenses in the lower part of the section.

Bulk sample BS-1125:

Bulk sample BS-1125 was located at boreholes SY-86 & SY-87. A total of 600t of gravel were sampled during August 26 - 28, 2014 and transported to Shefa Gems' processing facility for storage and treatment. In this section of the Mid-Reach of the Kishon catchment, the gravels attain thicknesses of more than 6m (Figures 22 & 23). It is worth noting that the thicknesses increase to the west, towards the present-day Kishon River.

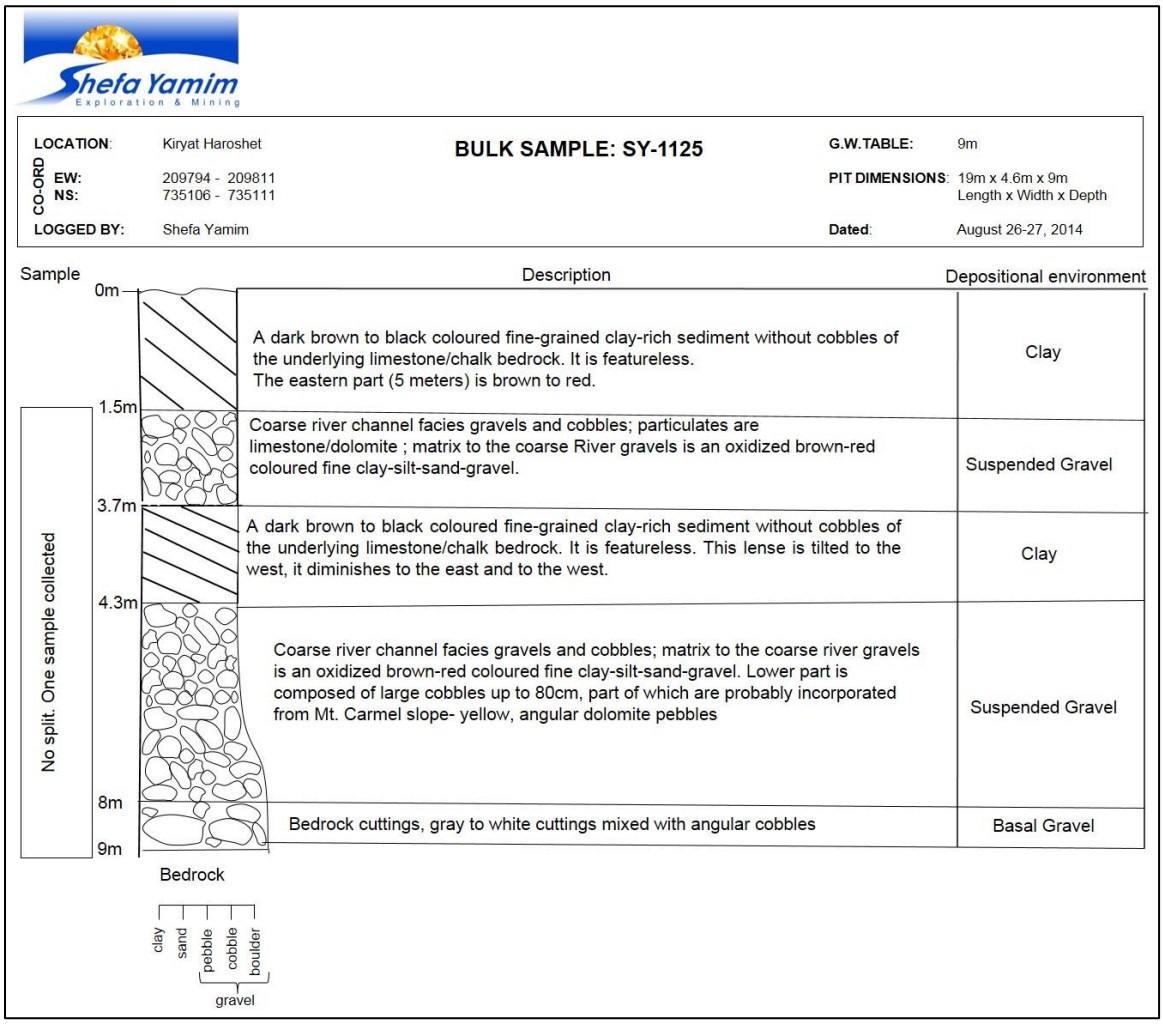


Figure 22: Trench wall stratigraphy of bulk sample BS-1125.

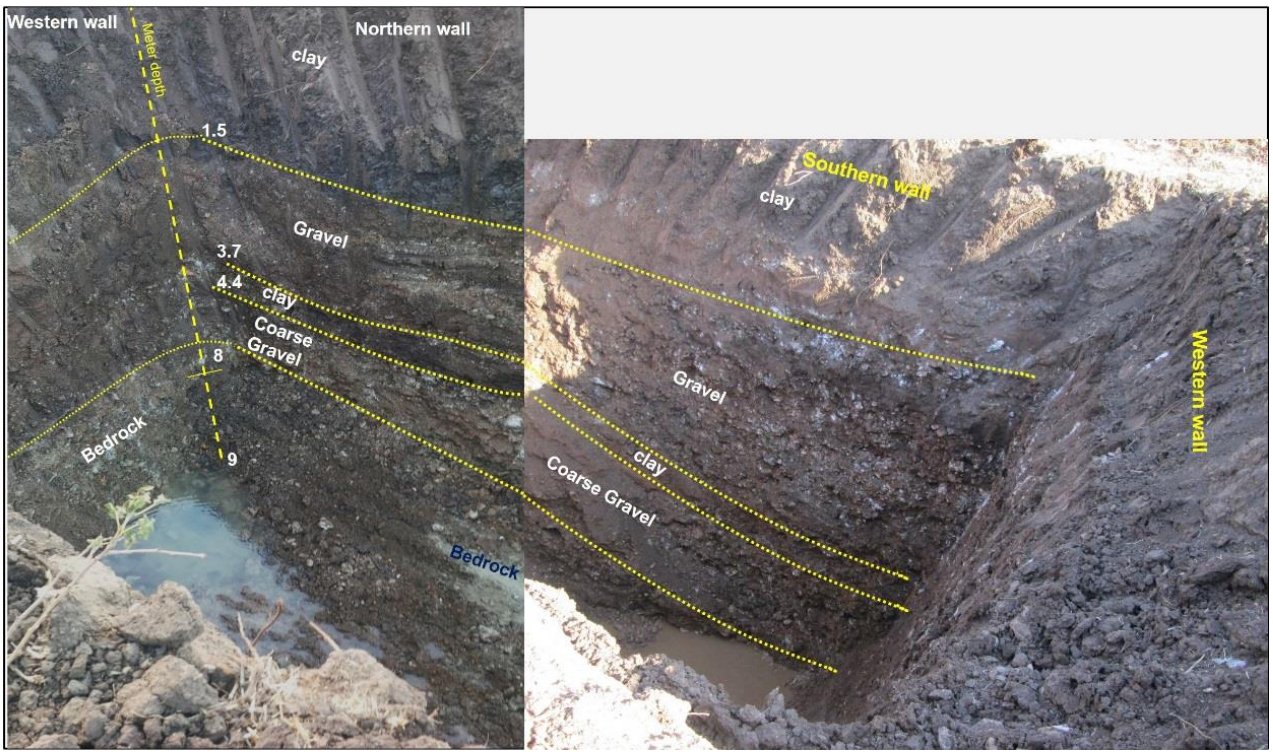


Figure 23: Bulk sample BS-1125 excavated down to bedrock some 8m below surface.

Bulk sample BS-1174:

Subsequent to the intensive exploration work in the Kishon River Mid-Reach, including a dense grid of boreholes (SY-65 to SY-109) and two bulk samples (SY-1124 & SY-1125), a new bulk sampling programme was initiated. The bulk sampling positions were sited based on optimal placer formation criteria and to cover two areas of interest within the Kishon River Mid-Reach Placer. Two new bulk samples were trenched on July 2015.

Bulk sample BS-1174 was sited at boreholes SY-68C to SY-69A and east of bulk sample BS_1124. A total of 533t of gravel was sampled and transported to the Shefa Gems plant for storage and treatment. In this sample the TMA was represented by all minerals, except diamond, with a total of 862.14 carats of heavy minerals recovered, giving an overall grade of 162cpht at a bottom screen size of 1mm. This overall grade for bulk sample BS-1174 is lower than the total grade returned from bulk sample BS-1124 (358cpht), a 45% reduction that highlights the nugget effect of heavy mineral distribution in alluvial systems. As in Bulk Sample BS-1124, the Bulk Sample BS-1174 alluvial placer minerals were dominated by the Carmel Sapphire™ component (43%), followed by the HIM suite minerals Garnet (38%) and Ilmenite (12%) with the sapphires running at some 5%. Minor contributions came from the HIM minerals Zircon (0.61%) and Rutile (0.21%) with the Gem Box suite rare minerals being Moissanite (0.1%) and Ruby (0.06%). The recovered grade of Carmel Sapphire™ was 70 cpht with one substantial stone of 19.55cts. This is 28% of the 248cpht returned for the Carmel Sapphire™ component of BS-1124, which also yielded two large stones (23.4ct and 12.22ct). In contrast, the Sapphire grade in BS-1174 of about 8cpht is nearly 30% higher than the 6cpht recovered in BS-1124 but with no medium-sized nor coarse-grained stones found. These results further substantiate the nugget effect related to trap site development in alluvial systems such as those found in the Mid-Reach of the Kishon Valley.

In BS-1174 (Figures 24 & 25), the bulk of the heavy minerals recovered (90%) lie in the 0.01 - 0.65 carat range, with some 5% in the 0.66 – 2.5 carat range and a further 5% larger than 2.5 carats. BS-1174 was the second bulk sample completed in the exploration exercise to determine a resource estimate of the multi-commodity, Kishon Mid-Reach alluvial placer.

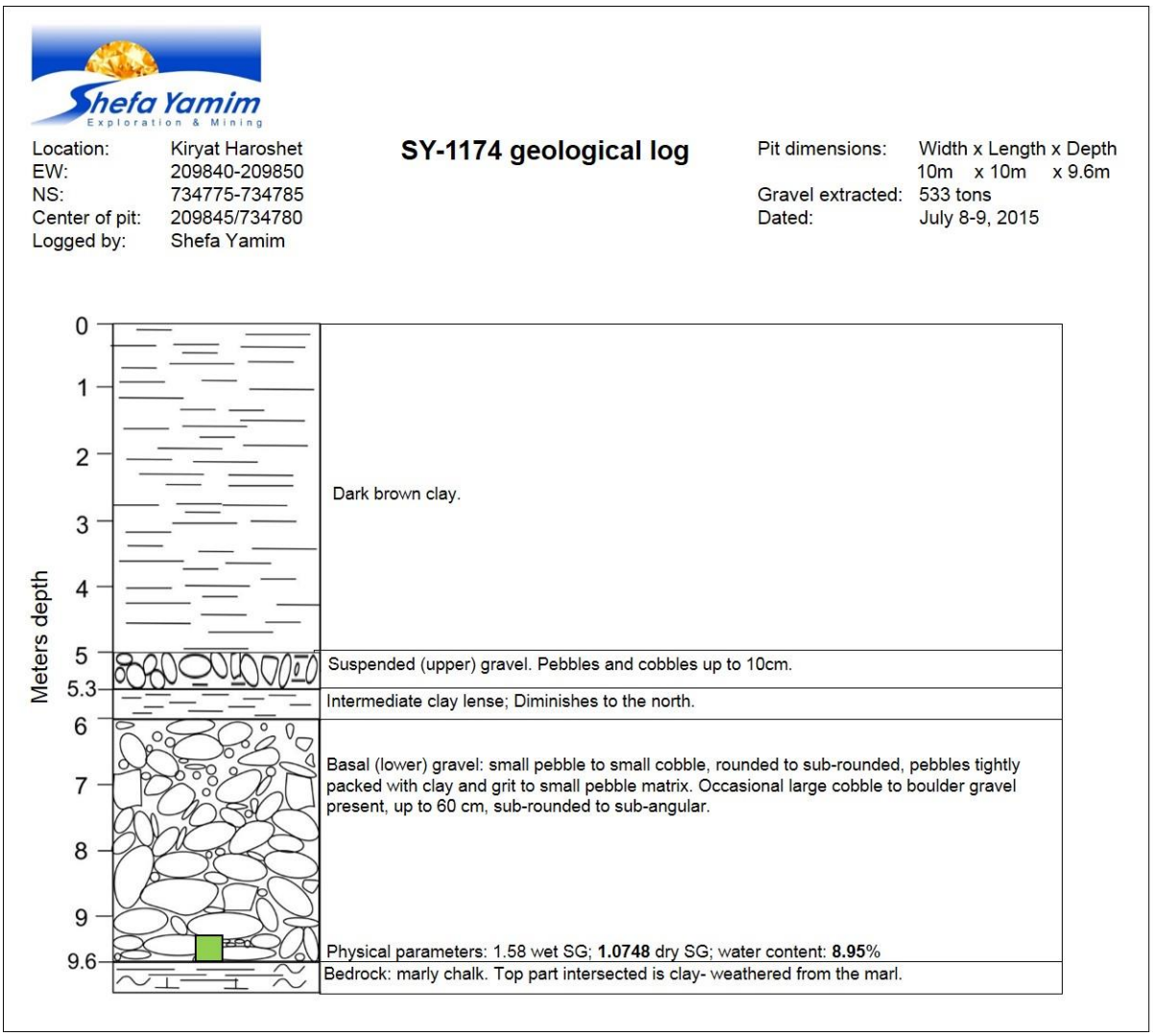


Figure 24: Preliminary trench wall stratigraphic sketch of bulk sampling BS--1174. Green box indicates the specific gravity field test location.

Figure 25: Field photos of bulk sample BS-1174

Bulk sample BS-1175:

As part of the new bulk sampling programme planned according to the recommendations of the geological consultants, bulk sample BS-1175 was planned near boreholes SY-69B to SY-69C and east of bulk sampling BS-1174 (Figure 25). A total of 533t of gravel was sampled during July 8 - 9, 2015 and transported to the Shefa Gems plant for storage and treatment. Treatment of sample BS-1175 started during March 2016. A similar stratigraphy to that of sample BS-1174 was recorded at sample BS-SY-1175, but it also had an interbedded clay layer (Figures 26, & 27).

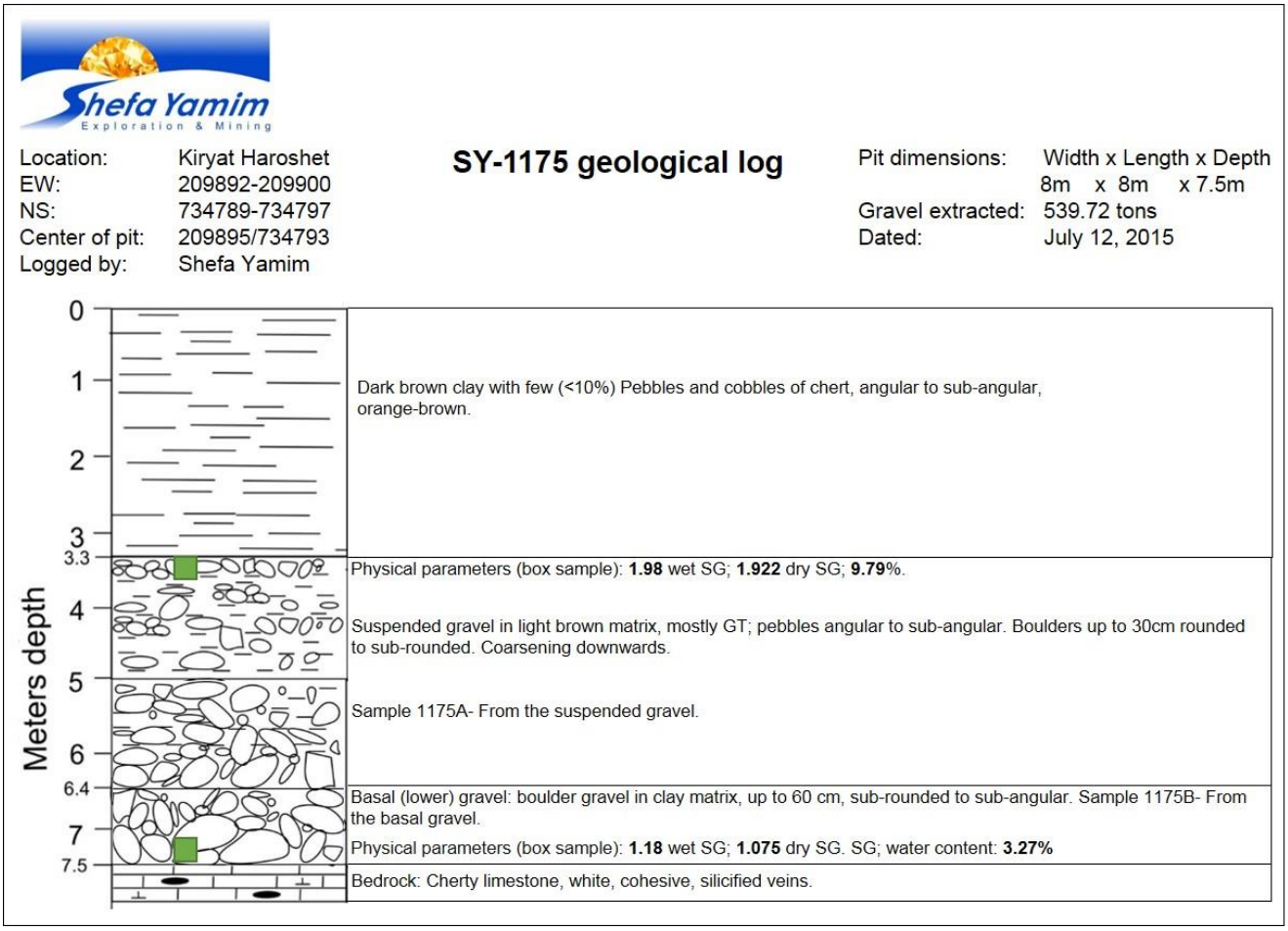


Figure 26: Trench wall stratigraphy of bulk sample BS-1175. Green boxes indicate specific gravity field test locations.

Figure 27: Field photos of bulk sampling BS-1175

9.3.6.2.2 Bulk sampling in Zone 2 (Bulk sample in BS-982 area)

This area is currently subjected to extensive exploration due to good TMA recoveries from borehole samples. Sample 982 totalled 400t of TMA-bearing gravel. It should be noted that a diamond was recovered in borehole SY-18, located approximately 53m northeast of bulk sample 982 at a depth of 4.5m below the surface. Bulk sample 990 (17t) recovered the largest sapphire crystal, 5.72 carat, out of a total of 39.6 carats sapphire from this bulk sample.

Bulk sample BS-982:

Bulk sample BS -982 (Figure 28 & 29) was excavated during May 21-23, 2012 in a field near the Kishon River within Zone 2 of Shefa Gems' Mid-Reach exploration target.

The 400t sample produced 54.99 carats sapphire, 29.77 carats Carmel Sapphire™, 1.97 carats ruby and 5.94 carat moissanite including a 4.1mm crystal and an appreciable yield of heavy minerals (Figure 29). The complete TMA was recovered, excluding diamonds.

Figure 28: Bulk Sample BS-982 – overburden removal.

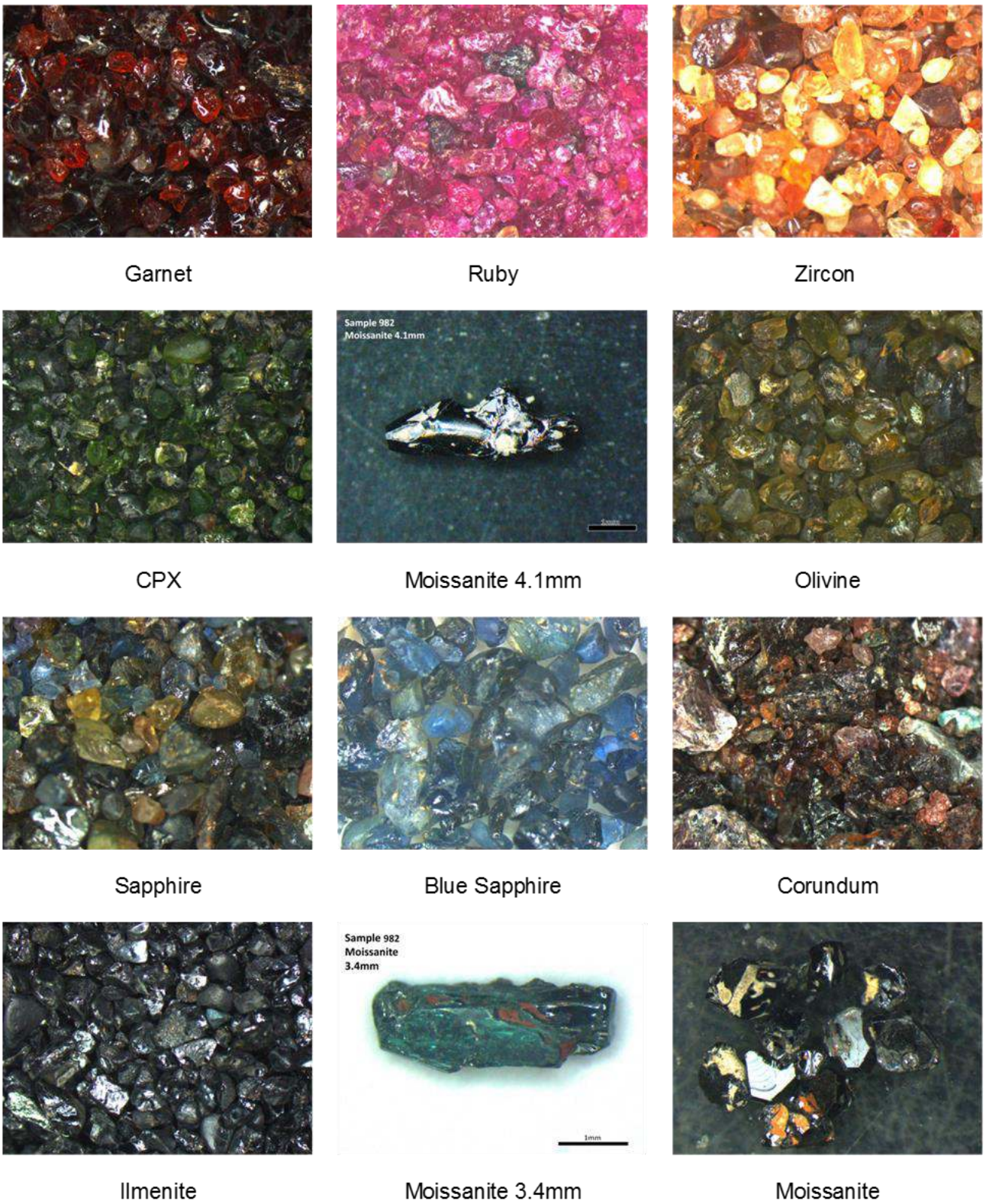


Figure 29: Bulk Sample BS-982 minerals recovered. This sample yielded a total of 6ct moissanite including a 4.1mm stone, the largest ever recorded worldwide.

9.3.6.3 Density

Density determination during the pit and bulk sampling was done following a standard operating procedure since 2010 during the sampling of the Rakefet River (Rakefet Magmatic Complex drainage) and the Rakefet River alluvial fan (samples SY-690, 691, 707) as well as the Yoqneam River catchment

(samples SY-771 and SY-787). Here it was determined that a gross value of **1.8**g/cm^3 for gravel bulk density and **1.4**g/cm^3 for clay bulk density apply to the basal gravel and clay overburden facies consistently.

Bulk sample densities results obtained

BS-690: Bulk densities: 1.4 g/cm^3 for clay; 1.8 g/cm^3 for gravel

BS-691: Bulk densities: 1.4 g/cm^3 for clay; 1.8 g/cm^3 for gravel

BS-707: Bulk densities: 1.4 g/cm^3 for clay; 1.8 g/cm^3 for gravel

BS-771: Bulk densities: 1.4 g/cm^3 for clay; 1.8 g/cm^3 for gravel

BS-787: Bulk densities: 1.4 g/cm^3 for clay; 1.8 g/cm^3 for gravel

During July 2015, as part of a new intensive bulk sampling campaign designed for the Mid-Reach exploration target this density measurement standard operating procedure was also applied during the extraction of bulk samples: BS-1174 and BS-1175. Here it was done using large squire metal boxes, purposely designed for this analysis and for all future bulk samplings.

BS-1174: Dry SG: 1.0748; (wet SG: 1.58; water content: 8.95%)

BS-1175 (suspended gravel): Dry SG: 1.922; (wet SG: 1.98; water content: 9.79%)

BS-1175 (basal gravel): Dry SG: 1.075 (wet SG: 1.18; water content: 3.27%)

9.3.7 Thin Sections and Petrographic Descriptions

A total of 26 thin sections were produced out of samples from volcanic complexes on Mt. Carmel. Thin sections were analysed at Ben-Gurion University (Beer Sheva, Israel) and at De Beers Africa Exploration (SA) laboratories. In general, the analyses indicate that some of the volcanic rocks are para-kimberlite lamprophyre rocks and also notes the presence of eclogites in samples. Later additional samples were taken by Prof. Bill Griffin and Prof. Sue O'Reilley for additional analysis and petrographic studies.

9.4. Recent Exploration

Recent exploration conducted since December 2017 in Kishon Mid-Reach Zone 1 and Zone 2 refers to all exploration carried out in the frame of Exploration permit 869B7, 869B8, 869B11 and Prospecting Licences No. 869C9 and No. 869C10. Work commenced in June 2018 and included the continuation of the bulk sampling programme in Kishon Mid-Reach Zone 2 with the purpose of establishing the geological continuity of gemstone bearing gravels as well as the continuity of gemstone grades recorded earlier over the project area.

The bulk sampling completed at the Kishon River Mid-Reach is summarised in Table 4 and is illustrated in figure 30.

Table 4: Bulk Sampling Kishon Mid-Reach Zone 1 & 2

ZONE	Sample No	Date of sampling	Treatment start date	Treatment finished date	Total sample weight (Ton)	Total Ct. all TMA	Total Ct. GEM only	CPHT
1	1124	2014-08-24	2015-04-26	2015-11-09	400 .00	1962 .21	1958 .48	490 .55
	1125	26-27/08/14	2015-02-01	2016-08-16	600 .00	1905 .74	1900 .51	317 .62
	1174	08-09/07/15	2015-10-25	2016-02-23	533 .00	1478 .42	1471 .00	277 .38
	1175	2015-07-12	2016-02-22	2016-05-15	539 .00	454 .47	453 .75	84 .32
	1176	2016-09-04	2016-09-27	2017-05-25	508 .78	70 .71	70 .56	13 .90
	1208	2016-09-05	2018-03-18	2018-04-12	123 .46	21 .26	21 .26	17 .22
	1210	2016-09-06	2017-02-23	2017-05-21	551 .00	331 .57	330 .14	60 .18
	1211	2016-06-08	2017-07-09	2017-08-30	518 .00	590 .39	587 .52	113 .98
	1212	2016-09-19	24/08/2017	2017-11-26	535 .10	426 .00	425 .12	79 .61
	1213	2016-09-20	2017-01-02	2017-03-08	347 .28	536 .85	533 .56	154 .59
	1214	2016-09-22	2017-05-28	2017-07-13	529 .74	409 .45	406 .44	77 .29
	1226	2017-09-10	2018-01-08	2018-02-13	398 .96	240 .59	239 .15	60 .30
	1227	2017-09-11	2017-11-27	2018-01-07	551 .20	1149 .27	1135 .85	208 .50
	1228	2017-09-12	2018-02-14	2018-03-21	248 .90	180 .35	178 .34	72 .46
	Total Zone 1 = 14 Bulk Samples				6 384 .42	9778 .15	9732 .55	153 .16
2	900	2011-09-11	Not available	Not available	50 .00	254 .474	247 .473	508 .95
	901	2011-09-12	Not available	Not available	15 .00	37 .405	36 .866	249 .37
	934	2011-10-02	Not available	Not available	40 .00	88 .843	88 .386	222 .11
	935	2011-10-03	Not available	Not available	50 .00	68 .343	68 .117	136 .69
	980	2012-05-08	Not available	Not available	100 .00	61 .955	61 .275	61 .96
	981	2012-05-15	Not available	Not available	100 .00	150 .081	149 .452	150 .08
	982	2012-05-21	2012-06-01	2013-05-27	400 .00	773 .344	752 .885	193 .34
	990	2012-09-03	2013-02-03	2013-02-13	17 .15	469 .001	458 .145	2735 .50
	991	2012-09-03	2013-02-20	2013-02-27	17 .35	94 .108	90 .169	542 .57
	992	2012-09-03	2013-03-05	2013-03-07	15 .51	74 .087	73 .488	477 .83
	993	2012-09-03	2012-11-06	2012-11-08	10 .00	45 .473	45 .090	454 .73
	994	2012-09-03	2013-03-18	2013-03-13	11 .59	42 .826	41 .658	369 .51
	995	2012-09-04	2013-01-06	2013-01-30	29 .70	295 .680	288 .254	995 .56
	996	2012-09-04	2013-03-13	2013-03-17	10 .00	81 .040	79 .468	810 .40
	997	2012-09-04	2012-12-19	2012-12-23	10 .00	93 .201	91 .440	932 .01
	998	2012-09-05	2012-12-30	2013-01-03	10 .00	68 .178	67 .389	681 .78
	999	2012-09-05	2012-11-12	2012-11-20	10 .00	15 .215	14 .863	152 .15
	1000	2012-09-04	2013-03-10	2013-03-12	14 .49	96 .208	93 .754	663 .96
	1001	2012-09-05	2012-12-02	2012-12-05	10 .00	66 .386	65 .319	663 .86
	1002	2012-09-05	2012-11-25	2012-11-28	10 .00	41 .664	40 .483	416 .64
	1223	2017-08-24	2018-11-01	2019-01-01	690 .50	742 .149	734 .206	107 .48
	1224	2017-08-25	2018-08-23	2018-10-28	553 .18	541 .982	537 .940	97 .98
	1225	2017-08-27	2018-07-10	2018-08-22	566 .22	743 .561	737 .110	131 .32
	1229	2017-09-26	2018-05-13	2018-07-09	530 .00	527 .222	522 .960	99 .48
	1230	2017-09-27	2018-04-18	2018-06-11	568 .90	1380 .686	1365 .805	242 .69
	1252	2019-06-10			622 .35			
	1253	2019-06-11			333 .12			
	1254	2019-06-12	2019-06-16		767 .79			
	1255	2019-06-13			494 .64			
	1256	2019-06-13			37 .05			
	Total Zone 2 = 30 Bulk Samples				6 094 .53	6,853.11	6,751.995	175.85

Bulk sampling during the period December 2017 to August 2019

Zone 1

Here are the results from bulk samples BS-1212, BS-1227 and BS-1226, part of a fourteen bulk sample exploration campaign to determine a resource estimate for gem and other heavy minerals in Zone 1 of the Kishon Mid-Reach project. A total of 744.8 carats ("ct") of heavy minerals were recovered from 1 485 ton (t) of basal gravels with an overall heavy mineral grade of 50.1 ct per one hundred ton ("cpht"). The largest stones recovered were a 5.52 ct Sapphire and a 4.86 ct Carmel Sapphire™.

Bulk samples BS-1212, BS-1227 and BS-1226 are the tenth, eleventh and twelfth bulk samples to be processed from Zone 1 of the Kishon Mid-Reach exploration area. The samples consisted of 535t, 551t and 399t of basal gravels respectively. Although the Carmel Sapphire™ is the dominant gem mineral in most of the Zone 1 bulk samples to date, the southernmost bulk samples of BS-1226 and BS-1227 have returned higher sapphire values than the Carmel Sapphire™. In BS-1227 the recovery of 55.3ct of sapphire was the highest for a single bulk sample to date, whilst the individual sapphire recovered weighing 5.52ct was close to the largest ever discovered by Shefa Gems which was 5.72ct.

In these 3 bulk samples, the grades for the Gem Box suite were in line with prior bulk sampling results, which dispalyes a >95% dominance of these high value gemstone minerals. The concentration of minerals in these samples confirms the nugget effect in heavy mineral concentration expected in this alluvial deposit. The variation in overall grades is also in line with what might be expected for a placer with semi mobile trap sites. The TMA was represented by all minerals except for diamonds which have only rarely been found in the Kishon Mid-Reach area.

Bulk sample results announced on the 20th March 2018, covering some of the bulk samples treated during the period, saw a shift from the findings to date where the Carmel Sapphire™ had been the dominant gem mineral in most of Zone 1.

In addition, and following a review by Macquarie University, led by Professor Griffin, and Shefa Gems, the Company has confirmed the presence of hibonite in some of its bulk samples. Hibonite, is an incredibly rare gemstone only found in a few locations worldwide. Shefa Gems has discovered examples intergrown with grossite, fluorite, spinel and native vanadium of varying quality and size; the largest of which was a 2.83ct stone in historical bulk sample BS-1214 (Zone 1).

On 14 May 2018, Shefa Gems announced it has completed its bulk sampling campaign at the Kishon Mid-Reach Zone 1, following the exploration results from bulk samples BS-1208 and BS-1228, the last two bulk samples from a fourteen-bulk sample campaign carried out in Zone 1.

Bulk samples BS-1228 and BS-1208 mark the end of a bulk sampling campaign to determine a resource estimate in Zone 1 of the multi-commodity target mineral assemblage ("TMA Suite") in the Kishon Mid-Reach exploration area. The samples consisted of 249 ton and 123 ton of basal gravel

respectively. Sapphire was the dominant gem mineral from BS-1228 with the largest sapphire being 3.04 ct. The TMA in BS-1228 was dominated by the HIM Suite (85%).

In contrast, but in keeping with the majority of the earlier bulk samples, BS-1208 results were dominated by the Carmel Sapphire™ (37%), followed by the sapphire (16%). Although no diamond, moissanite, ruby or hibonite were recovered from BS-1208, this bulk sample was completely dominated by the Gem Box suite with zircon and rutile absent.

The largest gemstone recovered from BS-1208 was a 0.88 ct sapphire. Although a relatively small stone, this size is in keeping with the lowest TMA grade returned so far in Zone 1, of 7.93 cpht for BS-1208, pointing to immature trap site development at that locality in Zone 1.

The variation in overall grades is what might be expected for a placer with semi mobile trapsites. The TMA was represented by all minerals except for diamonds, which have only rarely been found in the Kishon Mid-Reach area – which hosts transient placers as opposed to terminal placers in the Distal Reach where most of the diamonds have been recovered to date.

Highlights from Bulk Sampling Campaign at the Kishon Mid-Reach Zone 1:

- Increase in total gemstone minerals to date by 99.5% to 9 778.15 cts with the recognition of gem quality spinel, KIM garnet and KIM ilmenite that were added to the DMCH suite to give a revised Gem Box suite.
- Zircon and rutile remain in the Heavy Industrial Mineral (HIM) suite.
- Spinel becomes the 9th gemstone to be added to the TMA suite following the recovery of a total of 3 952.91cts.
- Cutting and polishing confirms gemstone quality of garnets, a total of 2 176.77 cts were recovered.
- The original DMCH Suite renamed to Gem Box suite to reflect the addition of the new gemstone minerals.
- Garnets re-assigned to the Gem Box suite from the original HIM suite of heavy minerals made up of garnet, ilmenite, zircon and rutile ("HIM")
- Ilmenite greater than or equal to 1mm, was also re-assigned to the Gem Box suite from the HIM suite as it is found to be of gemstone quality, a total of 768.86 cts were recovered
- The revised TMA, dominated by the Gem Box suite, is comprised mainly of minerals that are ≤0.65 cts/stn (85%) with 15% being ≥0.65cts. The largest gems recovered were: Carmel sapphire™ 33.3ct, garnet 13.6ct, sapphire 5.7ct, spinel 6.2ct, hibonite 2.8ct and ruby 1.7ct
- The overall TMA grade was some 153 cpht (at a bottom screen size of 1 mm), with the grade dominated by 4 Gem Box suite minerals: spinel (69.91 cpht); Carmel sapphire™ (39.36 cpht); garnet (34.09 cpht) and ilmenite (12.06 cpht).

Completed processing of 14 bulk samples in Zone 1 produced a total of 9 778.15 carats from the 6 384 ton sampled. The mineral percentages are presented in figure 30.

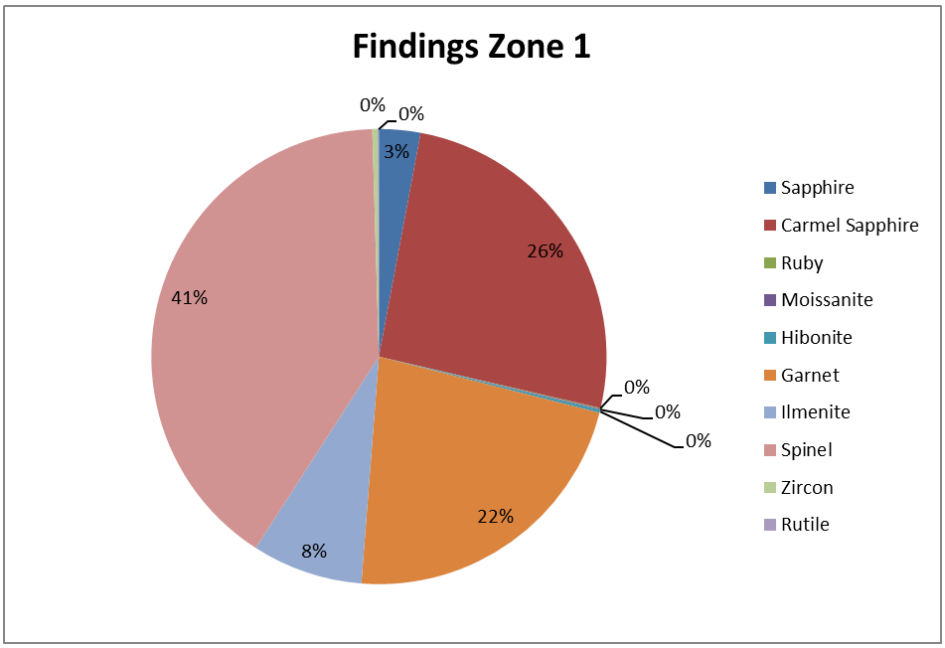


Figure 30: TMA assemblage from the bulk samples of zone 1.

Zone 2

Kishon Mid-Reach Zone 2 Bulk Sampling Programme:

The bulk samples are sourced from short trenches excavated approximately perpendicular to the paleo-flow direction of the ancient Kishon course preserved in low terraces flanking the modern river course. In following the system adopted for Zone 1, the bulk samples in Zone 2 have also be sited across the paleo-valley to form part of a sample grid to systematically investigate the gemstones content of the paleo-Kishon River basal placer gravels, except in the southern section where the valley is narrow and the samples were aligned roughly along palaeo-flow direction. .

The bulk sample trenches, 8 - 20 m long by 4 - 8 m wide, are excavated down to the bedrock (footwall) contact through a total sediment thickness of 5 - 8 m, of which the basal target gravels comprise 1 - 4 m. Approximately 250 to 700 tonnes of coarse basal gravels are removed from the field site to the dedicated treatment facility operated by Shefa Gems in Akko. There the bulk sample is scrubbed, screened (bottom screen size is 1 mm) and jigged (vibrated and washed) to concentrate the heavy minerals which are then hand-picked in a secure laboratory by trained personnel. All sample concentrates are kept for audit purposes and the basal gravel tailings are returned to the original bulk sample trench where, together with the overburden fines, the excavations are back-filled and rehabilitated.

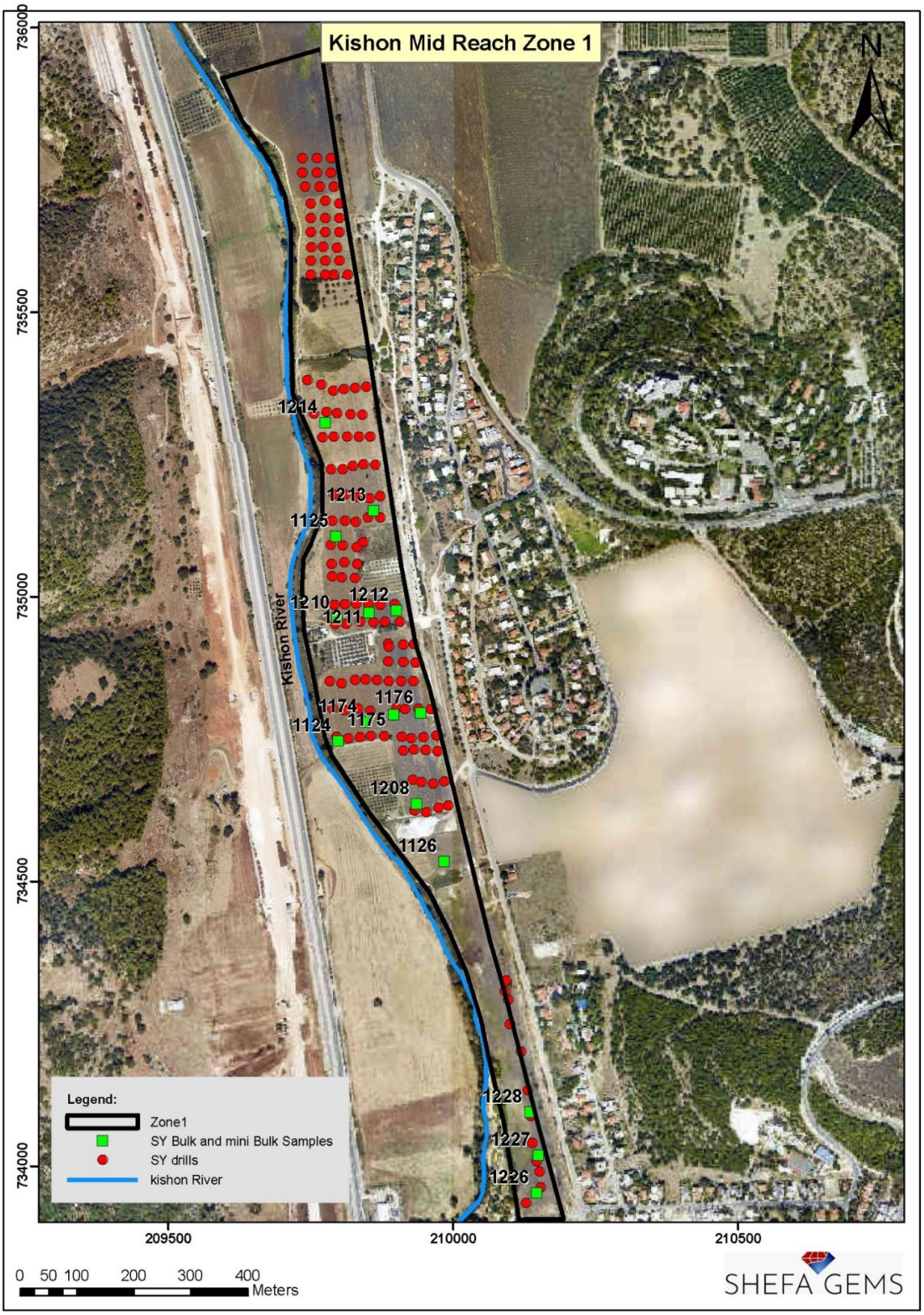


Figure 31: Zone 1 exploration area with drill hole and bulk sample positions.

In August 2017, Shefa Gems completed 5 bulk samples in the northern section of Kishon Mid-Reach Zone 2 including: BS-1223, BS-1224, BS-1225, BS-1229 and BS-1330. In addition, 2 new bulk samples BS-1229 and BS-1230 were done across the valley opposite to bulk samples BS-1223, BS-1224 and BS-1225. These samples have been processed to completion. In May 2018, the Company started processing the bulk samples collected between August and September 2017 from the southern section of the Kishon Mid-Reach Zone 2, where 5 bulk samples were excavated and 2 have been, to date, processed to completion.

On 10 July 2018 Shefa Gems, announced processing results from bulk sample BS-1230, the first of five bulk samples collected at the end of 2017 to determine the potential resource for the Kishon Mid-Reach Zone 2.

Bulk Sample BS-1230 Highlights:

- Largest gemstones recovered were a 6.20 ct spinel and a garnet of 3.61 carats (cts)
- The sample was dominated by gemstones (99%) with spinel accounting for 57% of the Target Mineral Assemblage ("TMA") followed by garnet 18%, ilmenite 15%, sapphire 5%, Carmel Sapphire™ 3% and the remaining 2% shared between hibonite, moissanite and ruby

A total of 1 380.69 cts of gemstones were recovered from 568.9 tonnes ('t') of basal gravels with an overall TMA recovered grade of 242.69 carats per hundred tonne ("cpht") at a bottom screen size of 1mm. Of this, the Gem Box suite comprised 99% of the TMA, with the heavy industrial minerals HIM suite of zircon and rutile accounting for the remaining 1%.

BS-1230 was the first sample from Zone 2 to incorporate spinel, ilmenite and garnet in the Gem Box suite, following the update of the Company's TMA announced 3 July 2018, due to their gem quality. The addition of spinel resulted in a significant increase in the overall TMA grade of BS-1230.

On 31 January 2019 Shefa Gems, announced they have completed the processing of five bulk samples from the northern section of the Kishon Mid-Reach Zone 2; following are the exploration results from bulk samples: 1223, 1224, 1225, 1229 and, as previously announced in July 2018, bulk sample 1230.

Bulk Samples Highlights:

- Largest gemstones recovered were a 3.90 ct Sapphire, 5.26 ct Carmel Sapphire™, 6.68 ct spinel and a 3.61 ct garnet
- Samples were dominated by gemstones (99%) with spinel accounting for 55% of the Target Mineral Assemblage ("TMA") followed by garnet 20%, ilmenite 16%, sapphire 4.5%, Carmel Sapphire™ 3% and the remaining 0.16% shared between hibonite, Natural Moissanite™ and ruby
- Significant increase in the overall grade following the updated TMA to include spinel in the Kishon Mid-Reach placer gemstones assemblage and with the formation of a revised Gem Box suite that incorporates nine gemstones
- Variety of gemstones recovered is consistent with previous bulk sample results strengthening Shefa Gems' position as a multi-commodity company

A total of 3 935.60 cts of gemstones were recovered from 2 908.8 tonnes ('t') of basal gravels with an overall TMA recovered grade of 135.30 carats per hundred ton ("cpht") at a bottom screen size of 1mm. Of this, the Gem Box suite comprised 99% of the TMA, with the heavy industrial minerals ("HIM") suite of zircon and rutile accounting for the remaining 1%.

The findings from bulk samples BS-1223, BS-1224, BS-1225, BS-1229 and BS-1230 add to previous Shefa Gems findings from historical bulk and mini bulk samples in Zone 2, which ranged between 10 and 690 ton each. To date a total of 25 bulk and mini bulk samples have been completed with a total of 3 839 ton of basal gravel and 6 853 carats of TMA suite recovered.

In Q2 2019, the Company planned to carry out an additional three bulk samples in Zone 2 in the area where 26 drilling surveys were completed in June 2018. The three bulk samples planned by Shefa Gems will conclude its exploration activity in Zone 2, preparing the Company for progress towards trial mining.

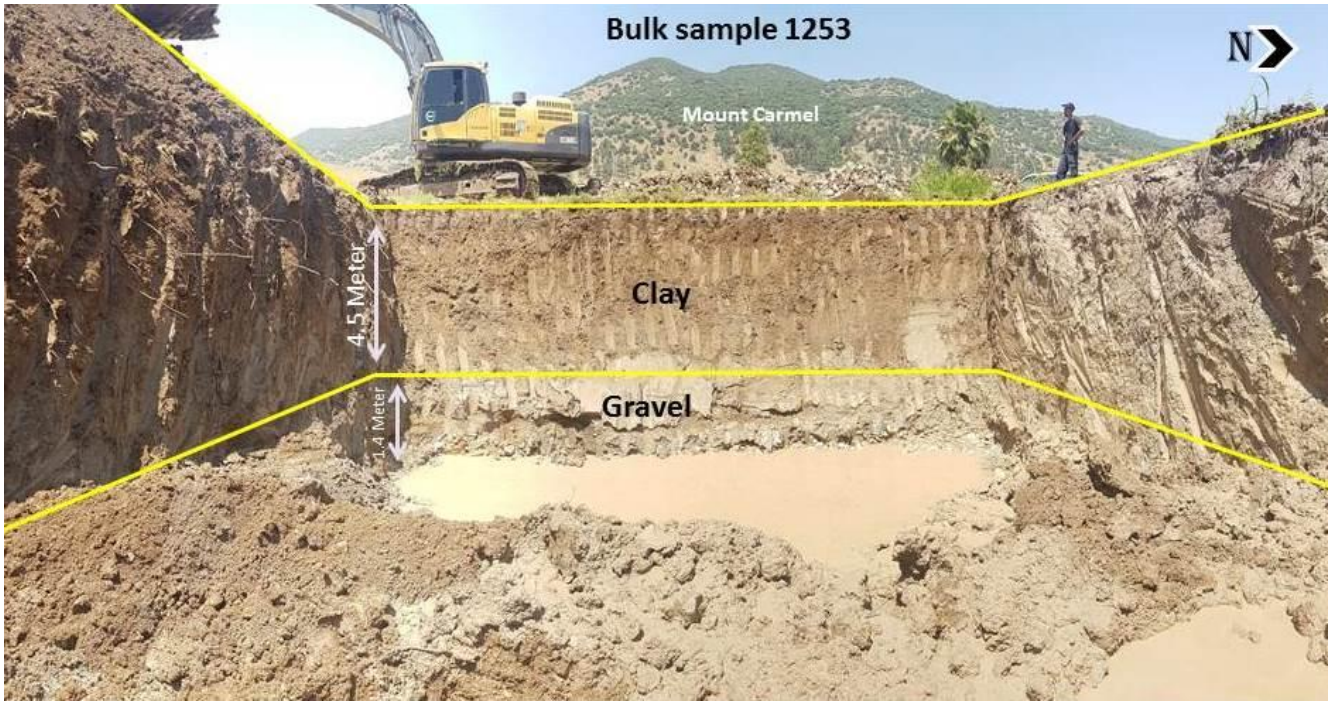


Figure 32*:* Excavation of bulk sample BS-1253 in Zone 2 of Kishon Mid-Reach showing the facies assemblage.

By June 2019, a total of 30 bulk and mini bulk samples have been collected from the Kishon Mid-Reach Zone 2 equalling 6 094 ton of gravel.

The extraction of the additional bulk samples, BS-1252, BS-1253, BS-1254, BS-1255 and BS-1256, is expected to conclude the exploration activity in Zone 2, one of the milestones set out in the Company's AGM Statement and Operational Update on 23 May 2019. The new collected samples, with a total weight of 2 255 ton, have been transported for treatment and analysis in the Company's operational site in Akko. Figures 32, 33 and 34 show the facies assemblages of BS-1253, BS-1254 and BS-1255, indicating the lithologies and their respective thicknesses.

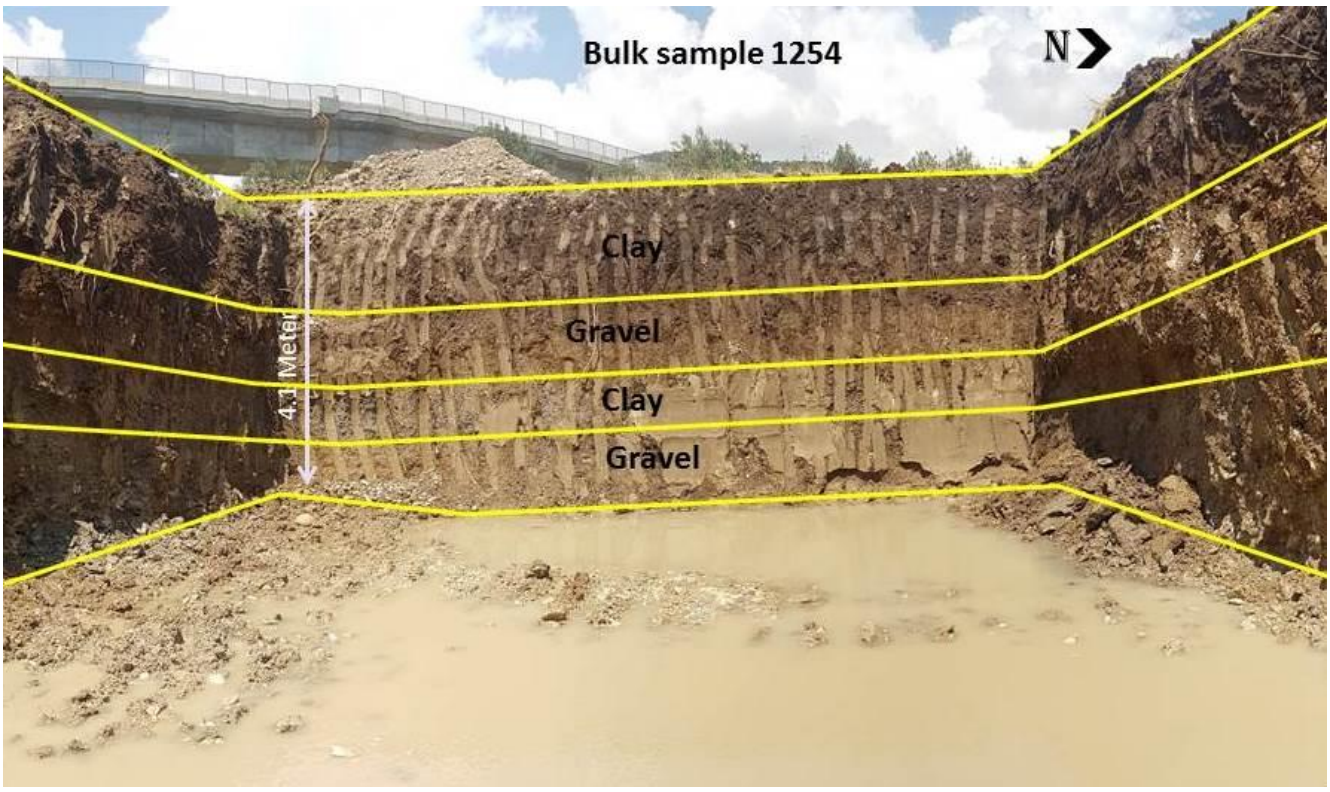


Figure 33: Bulk sample BS=1254 excavation in Zone 2 of Kishon Mid-Reach.

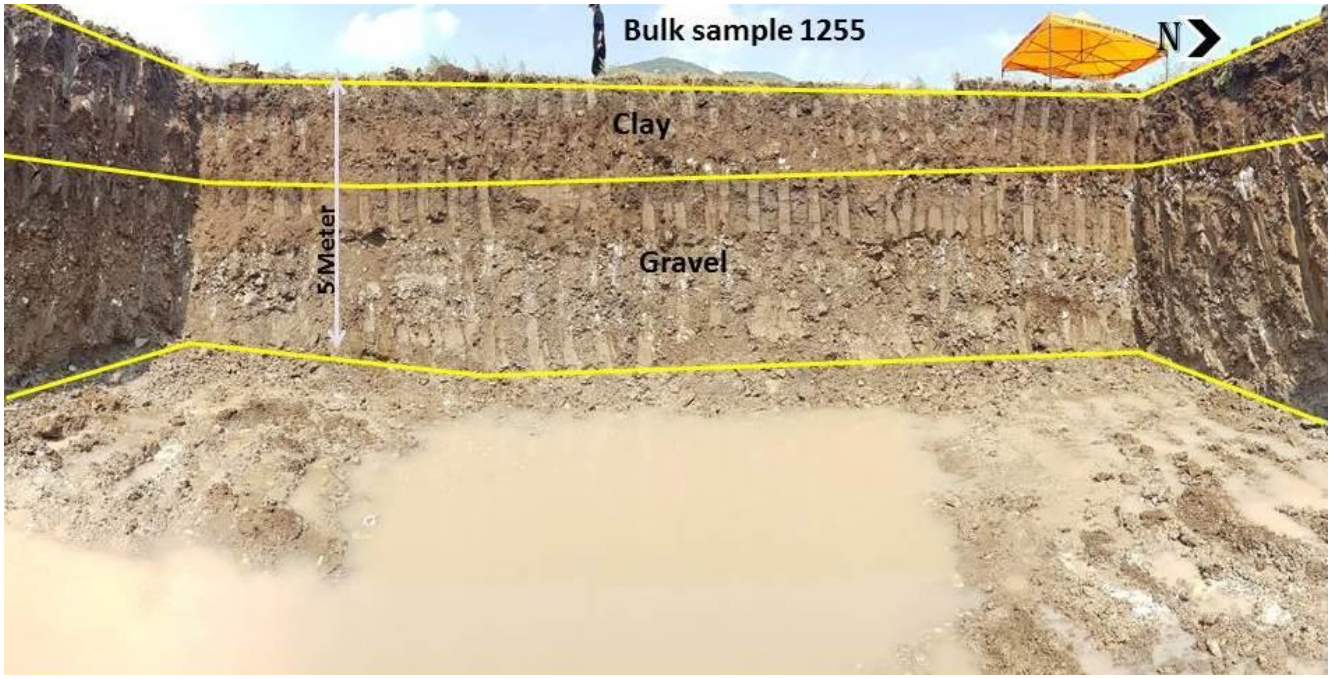


Figure 34: Bulk sample BS-1255 excavation in Zone 2 of Kishon Mid-Reach.

The 2019 exploration campaign expanded on the encouraging results from the 2018 bulk sampling campaign, which was completed in June 2018 with the results announced on 31 January 2019. The new (2019) bulk samples were excavated from a targeted area of the 2018 campaign where 26 drill

holes were completed. The 26 drill holes, with a diameter of 70cm each, drilled a total of 139.5 meters, yielding 58.37 ton of gravel and producing a total of 105.65 carats of the Target Mineral Assemblage ("TMA") Suite with a total grade of 170 carat per hundred tonnes (cpht) of gemstones, including Carmel Sapphire™ and sapphire. The mineral percentages are presented in figure 35.

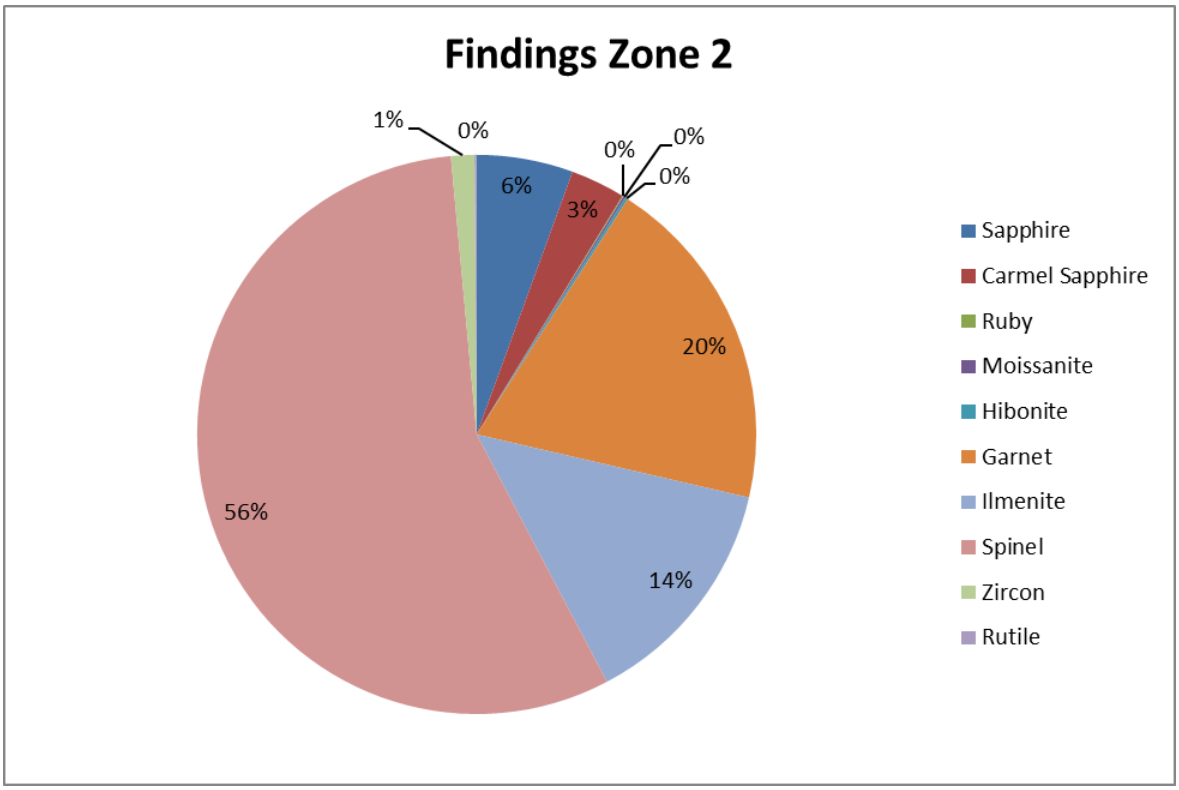


Figure 35: TMA assemblage from the bulk samples of Zone 2.

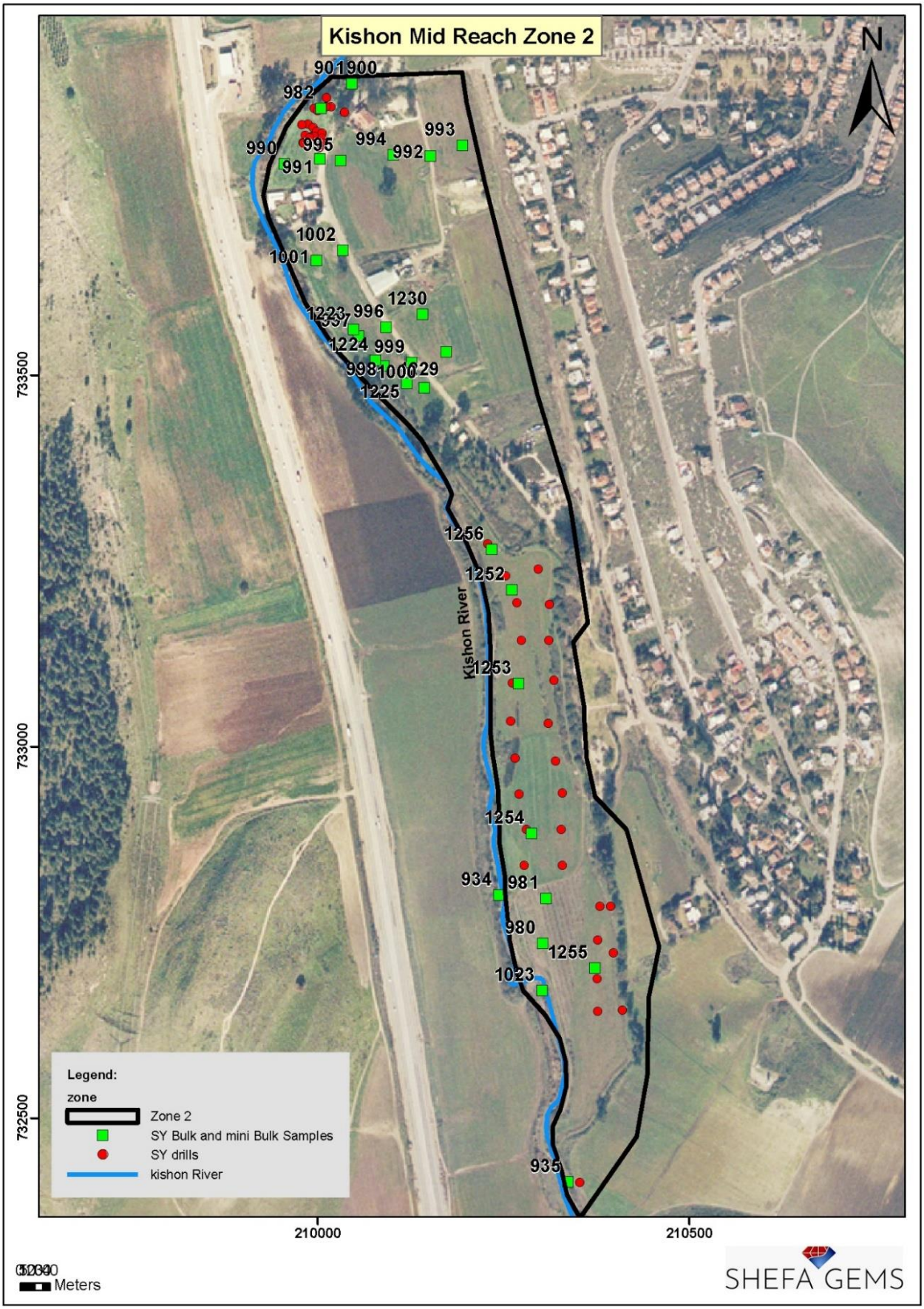


Figure 36: Zone 2 exploration area with drill hole and bulk sample positions.

10. Data Processing

10.1. Modelling

10.1.1 Mid-Reach Deposit Modelling

The Mid-Reach geological model comprises a single unit representing the mineralised entity, namely the gravel bed, being the host to the mineralisation in the Kishon River Valley. The following section describes the modelling methodology applied to the gravel unit mineralisation in particular, but also the modelling of bedrock morphology that plays an important role in placer development, as well as the overburden modelling. The focus is on the main findings to date at Zone 1 and Zone 2 in the Mid-Reach.

10.1.2 Valley-floor Modelling

The bedrock representing the valley floor was modelled from borehole data where the logged interface of valley-fill sediments (predominantly gravel) and bedrock in all boreholes was recorded (Figure 37).

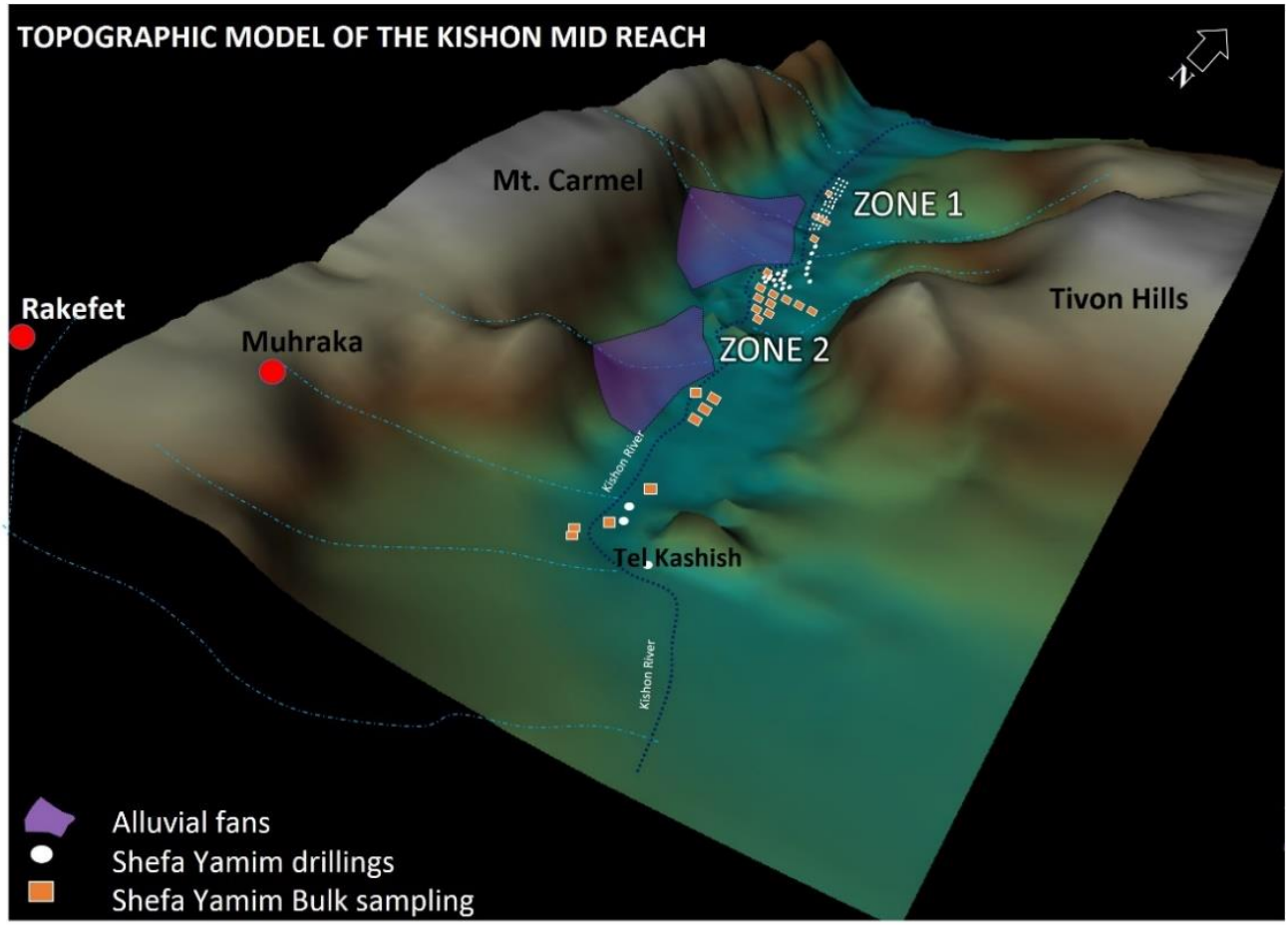


Figure 37: Mid-Reach Valley floor topography map. Note: not all the Bulk sampling are shown in this terrain model.

This valley floor surface, which is interpreted to represent the base level topography at the time of the gravel bed deposition, was obtained from the borehole logging database where this spatial data

was used to create a 2D wire frame and eventually a contour plot using Surfer™, of Golden Software Ltd for Zone 1 and Zone 2 (Figures 38, 39 and 40). Zone 1 shows a prominent bedrock depression on the western side of the valley. Elevated bedrock areas abruptly crossing over to bedrock depressions suggest the presence of scour pools. The valley floor contour data was used as bottom surface for the gravel bed model and an overburden basal contact surface wireframe, representing the interface between the gravel and the overburden material, was modelled using Golden Software's Surfer™. A 3D solid was then generated from the modelled hanging wall and footwall (valley floor) surfaces using Voxler™ 3D modelling software of Golden Software Ltd (Figure 39 & 40).

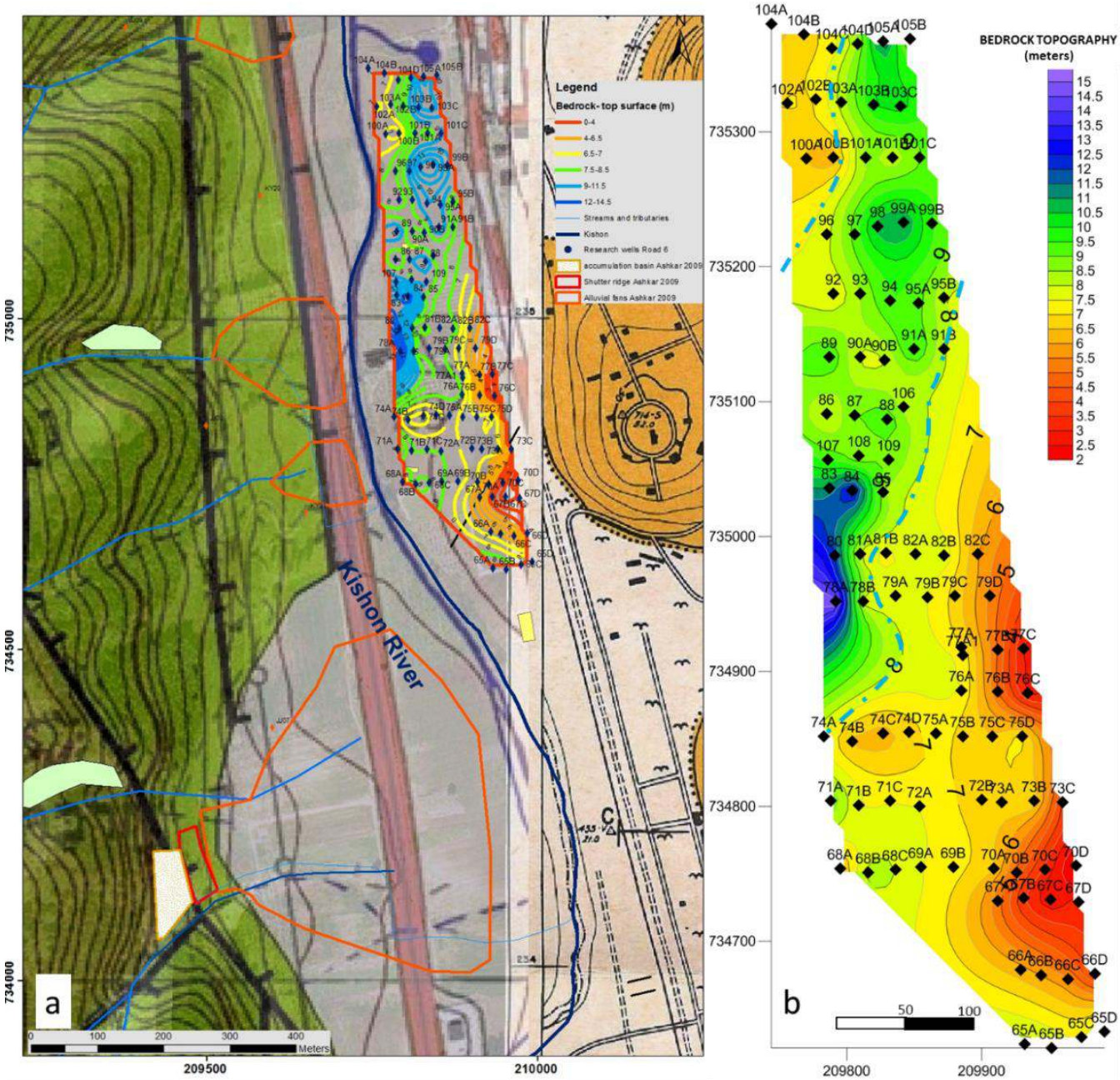


Figure 38: Zone 1 bedrock topography model.

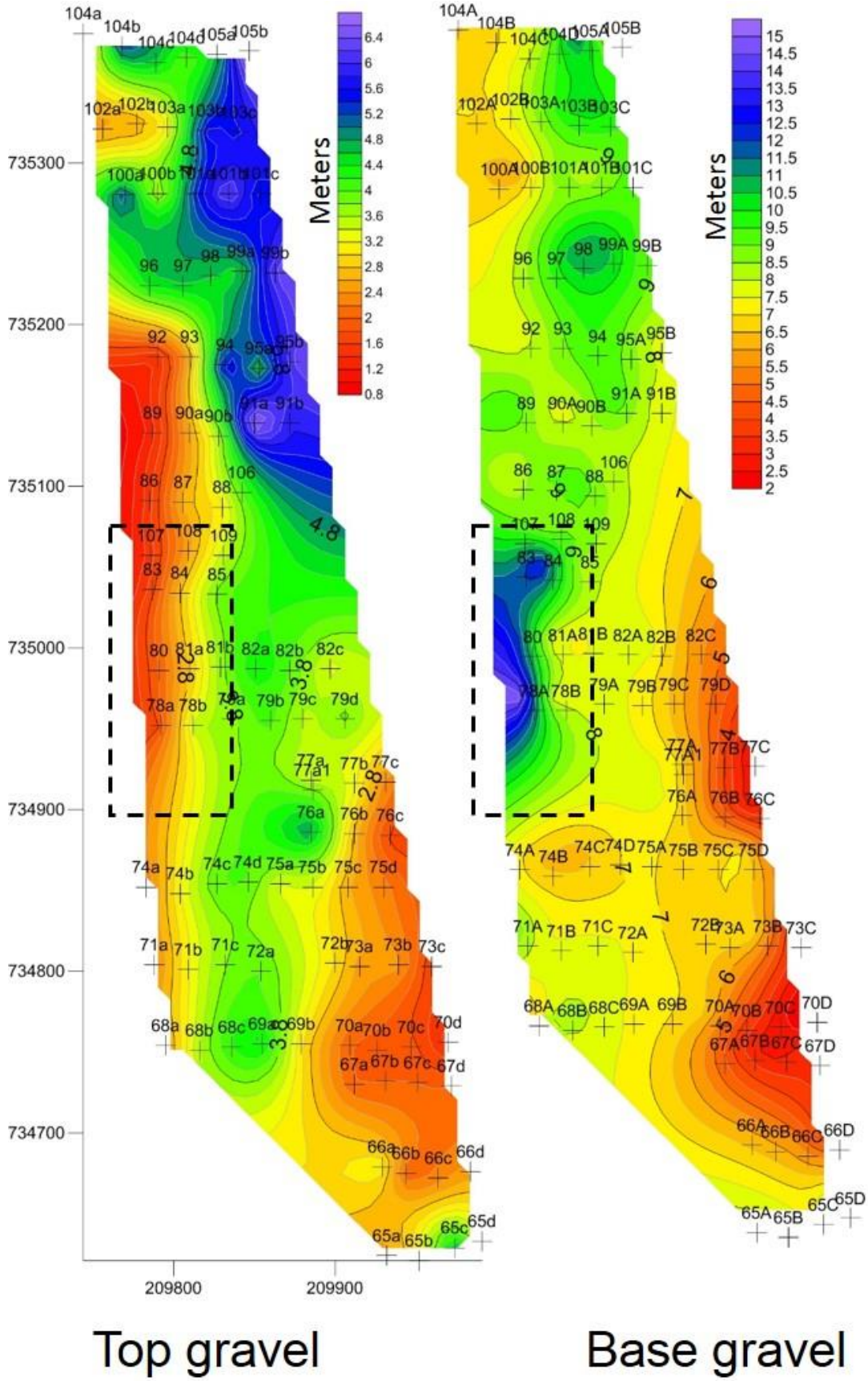


Figure 39: Contour plots of the base and top of the gravel unit in Zone 1. Dashed black box denotes a specific cell area where gravel thickness is promising: Base of gravel is low; top of gravel is high.

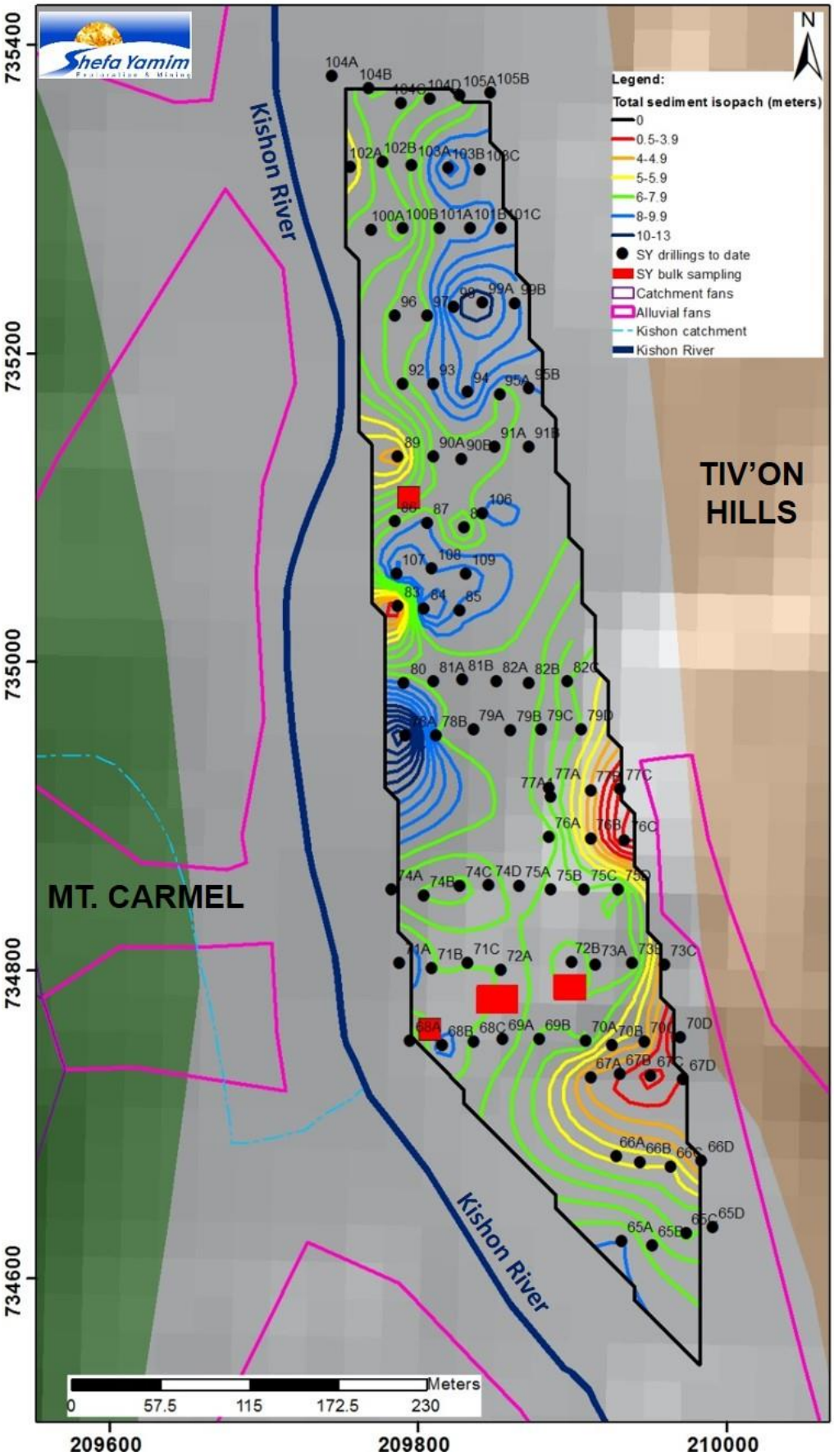


Figure 40: Contour map for the total sediment thickness (valley-fill) above the bedrock within the area of interest between boreholes SY-65 to SY-109 (Zone 1). Note the correlation between thick sediment cover and the alluvial fan to the west.

In areas where no gravel bed was intersected, the model was guided to pinch out to a zero thickness mid-way between mineralised and un-mineralised holes. The series of cross-sections generated on completion of the drilling campaign were used to verify modelling results (Figures 41 & 42).

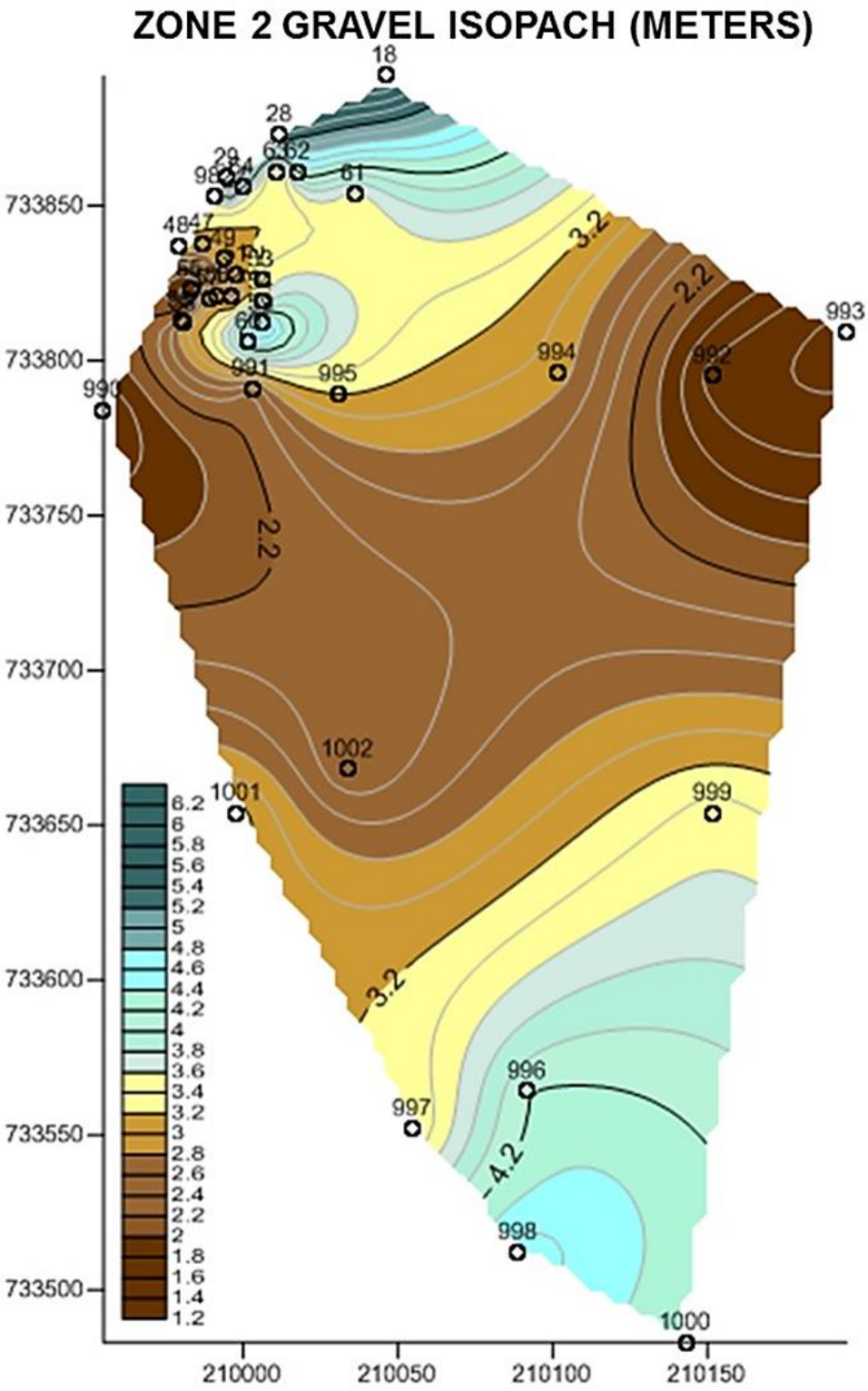


Figure 41: Contour map of the gravel thickness within the area of interest between boreholes SY-35 to SY-64 and bulk sampling 990 - 1002 (Zone 2).

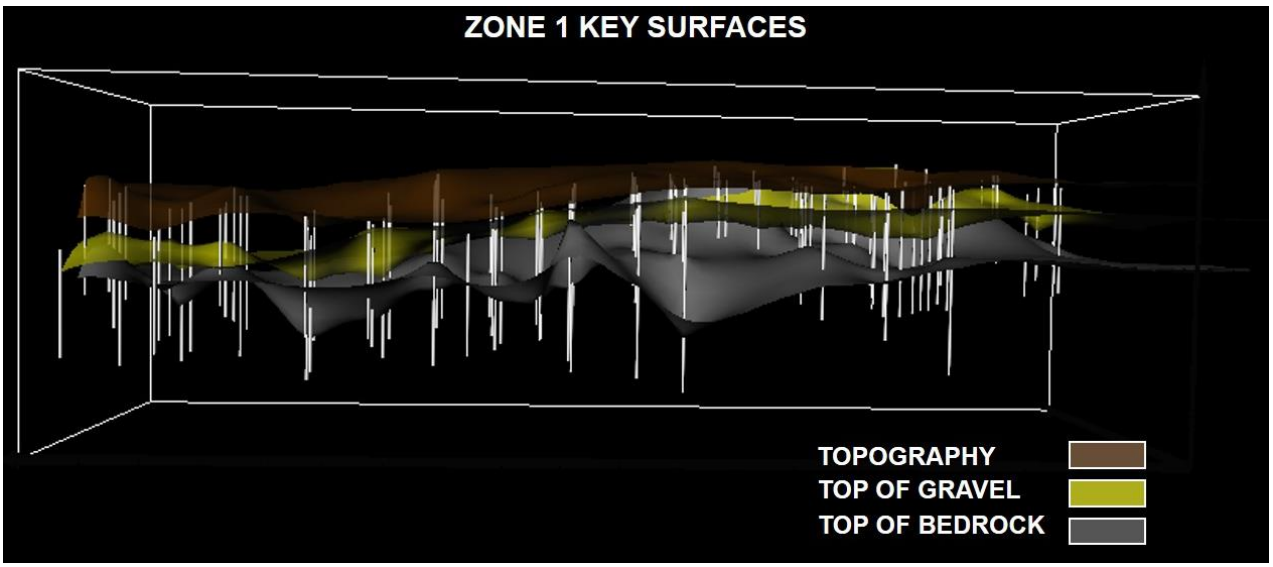


Figure 42: 3D view of the area represented by boreholes 65-109 (Zone 1), view to the east (Toledo *et al*., 2016).

10.1.3 Volume Estimation

The volume estimations done in 2017 were revised during late 2018 following the completion of the drilling and bulk sampling campaigns in Zone 1, together with the recent exploration advances in Zone 2 and the reconnaissance work at Zone 3.

The NFTR report, which was completed by consulting geologist, Dr John Ward in November 2018, provided updated estimates of the areas and tonnages for all three exploration target Zones. These updated estimates are derived from additional field mapping and drilling in Zones 1-3, including the successful awarding of the recently approved Prospecting Licence 869C9 that covers Zone 1 within the larger Exploration Permit 869B11.

Exploration target Shefa Gems Borehole area SY-65 to SY-109 (Zone 1, Figures 31, 42 and 43).

Zone 1 (Prospecting Licence 869C9) alone hosts approximately 1.1 million tonnes (Mt) of mineralised placer (basal) gravels overlain by almost 2 Mt of overburden.

Zone 1 - total surface area: 250 000m^2

Overburden (clay)

Estimated volume: **1 930 000 ton**

Gravel (basal)

Estimated gross volume: **1 120 000 ton**

Exploration target Shefa Gems boreholes SY-35 to SY-64 (Zone 2)

Zone 2 - total surface area: 269 000m^2

Overburden (clay)

Estimated volume: **1 698 000 ton**

Gravel (basal)

Estimated gross volume: **873 000 ton**

Exploration target Shefa Gems Zone 3

Zone 3 - total surface area: 788 000m^2

Overburden (clay)

Estimated volume: **6 621 000 ton**

Gravel (basal)

Estimated gross volume: **2 979 000 ton**

The total estimated geological (exploration) target and partial resource for all three exploration Zones is almost 5 Mt of placer (basal) gravels overlain by approximately 10 Mt of overburden in the Kishon Mid-Reach alluvial placer (Table 5).

Table 5: Kishon Mid-Reach alluvial placer resource volumes.

Zone	Area (m^2)	Overburden Ton (t)	Placer (Basal) Gravel Ton (t)
Zone 1	250 000	1 930 000	1 120 000
Zone 2	269 000	1 698 000	873 000
Zone 3	788 000	6 621 000	2 979 000
Total Mid-Reach	1 308 000	10 250 000	4 980 000

10.2 Mineral Processing

To date more than 75% of the 6 094.5t of the pit and bulk samples collected have been processed in the Shefa Gems' processing facility and laboratories at Akko with the primary objective of recovering the heavy mineral population including the gem minerals from the sampled gravels. The results are shown in Tables 6 and 7.

The alluvial, soil and rock samples collected in the permit area are transported to the Shefa Gems processing facility in Akko, north of Haifa for treatment. The treatment processes include crushing (if required), washing (scrubbing), screening, jigging and treatment of the fraction less <2mm in a "Water Column" processing system for the final concentration of heavy minerals if required. Standard

operating procedures are followed with proper validation systems such as tracer testing done routinely.

The concentrated minerals are sorted and representative sub-samples are subjected to XRD and XRF analysis. The mineralogical results are finally plotted on maps to facilitate the identification of anomalies of individual minerals and mineral assemblages. In addition, the petrogenesis of the minerals as determined by the chemical composition is also analysed. The procedures used are conventional for diamond and precious stone exploration and follow standard best practices principles used in the gem industry.

10.2.1 Mineral Processing Procedures

On arrival at the plant in Akko the samples are stockpiled in the processing facility yard and clearly marked with an identification number. The samples are then screened through a static grizzly screen that removes boulders larger than 100mm in diameter from the samples. The <100mm fraction is then washed in a scrubber that breaks up any clay agglomerates that might bind the material into clods.

The <0.5mm component of the sample, comprising mainly clay and fine grained sand, is put in suspension in the wash water and pump to settling ponds from where clear water returns to the storage reservoirs for re-use. At the scrubber the +0.5mm component of the sample is washed and classified into 5 fractions: (1) 0.5-0.7mm (2) 0.7-1mm (3) 1-2mm (4) 2-4mm (5) 4-6mm (6) +6mm. This washed and sized material is then transferred to the pulsating jig plant for gravity separation treatment. After gravity separation by means of the modified PLietz jig plant (multi-stage), samples follow different treatment streams based on size fractions (Figure 44). All sample processing work is done by following a detailed Standard Operating Procedure (SOP).

Samples in the -2mm size fraction are:

1. Dried, weighed and their sample date recorded.
2. Visual inspection and sorting in the recovery laboratory.
3. Data is recorded and incorporated into the database.
4. Samples in the -2mm size fraction is classified into 3 size categories (0.5-0.7mm, 0.7-1mm and 1-2mm) and jigged in the separate classes
5. The centre of the jig pan (concentrate) is collected, dried and sieved to size fractions.
6. Material on the outer part of the jig pan is discarded.
7. The “Water Columns” treat the material less than 2mm: 0.5-0.7mm, 0.7-1mm and 1-2mm.
8. Orange cube-shaped epoxy tracers with specific gravities of 3.53 and sizes of 1mm and 2 mm are used as tracer validation as part of the QA/QC process
9. Samples are then dried, weighed and recorded in the database.
10. Visual inspection and sorting in the recovery laboratory using binocular microscopes.
11. Data is recorded and incorporated into the database.

Table 6: Total weight of minerals in carats - Gem Box minerals from bulk samples in Zone 1.

ZONE	Sample No	Date of sampling	Start treatment date	Finished treatment date	Total weight of the sample (Ton)	Sapphire		Corundum (Carmel Sapphire™)		Ruby		Moissanite		Hibonite		Garnet		Ilmenite		Spinel		Total Ct. GEM only	CPT	CPHT
						Ct	%	Ct	%	Ct	%	Ct	%	Ct	%	Ct	%	Ct	%	Ct	%			
1	1124	2014/08/24	2015/04/26	2015/11/09	400,00	24,27	1,24%	991,43	50,62%	0,89	0,05%	3,54	0,18%	0,00	0,00%	349,16	17,83%	58,57	2,99%	530,62	27,09%	1958,48	4,90	489,62
	1125	26-27/08/14	2015/02/01	2016/08/16	600,00	40,45	2,12%	730,17	38,31%	0,86	0,05%	1,32	0,07%	5,34	0,28%	438,57	23,01%	108,83	5,71%	580,31	30,45%	1905,85	3,18	317,64
	1174	08-09/07/2015	2015/10/25	2016/02/23	533,00	41,13	2,80%	374,31	25,45%	0,48	0,03%	0,84	0,06%	0,00	0,00%	335,62	22,82%	102,43	6,96%	616,19	41,89%	1471,00	2,76	275,98
	1175	2015/07/12	2016/02/22	2016/05/15	539,00	4,78	1,04%	165,39	35,99%	2,15	0,47%	0,30	0,06%	5,85	1,27%	87,90	19,13%	16,05	3,49%	177,19	38,55%	459,59	0,85	85,27
	1176	2016/09/04	2016/09/27	2017/05/25	508,78	0,33	0,46%	28,28	40,06%	0,01	0,02%	0,17	0,24%	0,05	0,06%	14,80	20,96%	1,39	1,96%	25,59	36,24%	70,61	0,14	13,88
	1208	2016/09/05	2018/03/18	2018/04/12	123,46	1,58	7,45%	3,60	16,93%	0,00	0,00%	0,00	0,00%	0,00	0,00%	3,53	16,61%	1,08	5,07%	11,47	53,95%	21,26	0,17	17,22
	1210	2016/09/06	2017/02/23	2017/05/21	551,00	6,02	1,82%	24,81	7,51%	0,09	0,03%	0,05	0,02%	0,05	0,02%	110,72	33,53%	13,46	4,08%	174,99	53,00%	330,19	0,60	59,93
	1211	2016/06/08	2017/07/09	2017/08/30	518,00	26,54	4,52%	37,87	6,45%	0,04	0,01%	0,09	0,02%	0,00	0,00%	125,75	21,40%	47,57	8,10%	349,66	59,52%	587,52	1,13	113,42
	1212	2016/09/19	24/08/2017	2017/11/26	535,10	14,69	3,45%	42,39	9,95%	0,03	0,01%	0,06	0,01%	0,86	0,20%	35,81	8,41%	15,45	3,63%	316,69	74,34%	425,98	0,80	79,61
	1213	2016/09/20	2017/01/02	2017/03/08	347,28	23,98	4,49%	21,01	3,94%	0,02	0,00%	0,07	0,01%	0,28	0,05%	182,37	34,16%	101,04	18,93%	205,07	38,41%	533,84	1,54	153,72
	1214	2016/09/22	2017/05/28	2017/07/13	529,74	14,85	3,61%	42,34	10,29%	0,59	0,14%	0,11	0,03%	4,89	1,19%	109,73	26,68%	42,14	10,24%	196,68	47,82%	411,33	0,78	77,65
	1226	2017/09/10	2018/01/08	2018/02/13	398,96	12,98	5,43%	7,95	3,32%	0,00	0,00%	0,07	0,03%	0,07	0,03%	113,27	47,35%	57,64	24,10%	47,24	19,75%	239,22	0,60	59,96
	1227	2017/09/11	2017/11/27	2018/01/07	551,20	55,26	4,85%	38,23	3,36%	0,15	0,01%	0,04	0,00%	3,50	0,31%	185,04	16,24%	145,63	12,78%	711,50	62,45%	1139,35	2,07	206,70
	1228	2017/09/12	2018/02/14	2018/03/21	248,90	20,48	11,48%	5,06	2,84%	0,00	0,00%	0,00	0,00%	0,00	0,00%	84,50	47,38%	58,58	32,85%	9,72	5,45%	178,34	0,72	71,65
	Total Zone 1 = 14 BS				6 384,42	287,34	2,95%	2512,84	25,82%	5,30	0,05%	6,65	0,07%	20,89	0,21%	2176,77	22,37%	769,86	7,91%	3952,91	40,62%	9732,55	1,52	152,44

Table 7: Total weight of minerals in carats - Gem box minerals from bulk samples in Zone 2.

ZONE	Sample No	Date of sampling	Start treatment date	Finished treatment date	Total weight of the sample (Ton)	Sapphire		Corundum (Carmel Sapphire™)		Ruby		Moissanite		Hibonite		Garnet		Ilmenite		Spinel		Total Ct. GEM only	CPT	CPHT
						Ct	%	Ct	%	Ct	%	Ct	%	Ct	%	Ct	%	Ct	%	Ct	%			
2	900	2011/09/11	1900/01/00	1900/01/00	50,00	27,79	11,23%	0,40	0,16%	0,08	0,03%	0,07	0,03%	0,00	0,00%	53,29	21,53%	42,21	17,06%	123,63	49,96%	247,473	4,95	494,95
	901	2011/09/12	1900/01/00	1900/01/00	15,00	2,20	5,97%	0,84	2,28%	0,06	0,17%	0,14	0,37%	0,00	0,00%	11,96	32,45%	3,91	10,61%	17,75	48,14%	36,866	2,46	245,77
	934	2011/10/02	1900/01/00	1900/01/00	40,00	0,96	1,09%	2,77	3,13%	0,04	0,05%	0,59	0,67%	0,00	0,00%	22,63	25,60%	21,73	24,58%	39,67	44,88%	88,386	2,21	220,97
	935	2011/10/03	1900/01/00	1900/01/00	50,00	0,63	0,92%	1,59	2,33%	0,12	0,18%	0,53	0,78%	0,73	1,07%	37,37	54,86%	0,85	1,25%	26,30	38,60%	68,117	1,36	136,23
	980	2012/05/08	1900/01/00	1900/01/00	100,00	2,83	4,63%	10,11	16,50%	0,14	0,23%	0,09	0,15%	0,00	0,00%	14,91	24,34%	9,35	15,27%	23,83	38,89%	61,275	0,61	61,28
	981	2012/05/15	1900/01/00	1900/01/00	100,00	2,21	1,48%	38,88	26,02%	0,50	0,34%	0,25	0,17%	3,12	2,08%	29,60	19,80%	11,57	7,74%	63,32	42,37%	149,452	1,49	149,45
	982	2012/05/21	2012/06/01	2013/05/27	400,00	54,99	7,30%	29,77	3,95%	1,97	0,26%	5,94	0,79%	0,00	0,00%	163,28	21,69%	61,87	8,22%	435,06	57,79%	752,885	1,88	188,22
	990	2012/09/03	2013/02/03	2013/02/13	17,15	41,14	8,98%	1,12	0,24%	0,06	0,01%	0,15	0,03%	0,46	0,10%	26,25	5,73%	40,62	8,87%	348,35	76,04%	458,145	26,72	2672,18
	991	2012/09/03	2013/02/20	2013/02/27	17,35	8,34	9,25%	0,61	0,68%	0,00	0,00%	0,04	0,04%	0,00	0,00%	14,89	16,51%	9,85	10,92%	56,44	62,60%	90,169	5,20	519,86
	992	2012/09/03	2013/03/05	2013/03/07	15,51	2,12	2,88%	0,96	1,30%	0,00	0,00%	0,03	0,04%	0,65	0,88%	12,16	16,55%	9,10	12,38%	48,48	65,96%	73,488	4,74	473,96
	993	2012/09/03	2012/11/06	2012/11/08	10,00	1,51	3,35%	0,42	0,93%	0,00	0,00%	0,00	0,00%	0,00	0,00%	12,95	28,71%	8,06	17,87%	22,15	49,13%	45,090	4,51	450,90
	994	2012/09/03	2013/03/18	2013/03/13	11,59	3,72	8,93%	0,69	1,65%	0,01	0,02%	0,02	0,05%	0,02	0,05%	6,57	15,78%	6,43	15,44%	24,19	58,08%	41,658	3,59	359,43
	995	2012/09/04	2013/01/06	2013/01/30	29,70	28,20	9,78%	5,22	1,81%	0,44	0,15%	0,23	0,08%	0,11	0,04%	52,97	18,38%	28,05	9,73%	173,03	60,03%	288,254	9,71	970,55
	996	2012/09/04	2013/03/13	2013/03/17	10,00	3,58	4,50%	0,29	0,37%	0,01	0,01%	0,00	0,00%	0,01	0,01%	15,27	19,22%	10,40	13,09%	49,90	62,80%	79,468	7,95	794,68
	997	2012/09/04	2012/12/19	2012/12/23	10,00	3,66	4,00%	0,15	0,17%	0,01	0,01%	0,06	0,07%	0,16	0,18%	20,22	22,11%	16,20	17,72%	50,98	55,75%	91,440	9,14	914,40
	998	2012/09/05	2012/12/30	2013/01/03	10,00	2,15	3,19%	1,58	2,34%	0,03	0,04%	0,09	0,13%	0,00	0,00%	13,76	20,42%	9,00	13,35%	40,78	60,52%	67,389	6,74	673,89
	999	2012/09/05	2012/11/12	2012/11/20	10,00	1,08	7,27%	0,61	4,10%	0,00	0,00%	0,17	1,14%	0,00	0,00%	2,78	18,67%	2,48	16,71%	7,75	52,11%	14,863	1,49	148,63
	1000	2012/09/04	2013/03/10	2013/03/12	14,49	10,21	10,89%	1,05	1,12%	0,21	0,22%	0,04	0,04%	0,00	0,00%	15,13	16,14%	9,62	10,26%	57,50	61,33%	93,754	6,47	647,03
	1001	2012/09/05	2012/12/02	2012/12/05	10,00	4,27	6,54%	0,31	0,47%	0,00	0,00%	0,03	0,05%	0,00	0,00%	10,36	15,87%	7,89	12,07%	42,46	65,01%	65,319	6,53	653,19
	1002	2012/09/05	2012/11/25	2012/11/28	10,00	4,01	9,91%	0,49	1,21%	0,00	0,00%	0,00	0,00%	0,00	0,00%	5,30	13,10%	2,83	6,99%	27,85	68,79%	40,483	4,05	404,83
	1223	2017/08/24	2018/11/01	2019/01/01	690,50	40,79	5,56%	25,79	3,51%	0,08	0,01%	0,14	0,02%	0,00	0,00%	190,68	25,97%	146,76	19,99%	329,97	44,94%	734,206	1,06	106,33
	1224	2017/08/25	2018/08/23	2018/10/28	553,18	21,91	4,07%	23,02	4,28%	0,04	0,01%	0,04	0,01%	1,00	0,19%	122,59	22,79%	93,29	17,34%	276,05	51,32%	537,940	0,97	97,25
	1225	2017/08/27	2018/07/10	2018/08/22	566,22	19,77	2,68%	14,24	1,93%	0,00	0,00%	0,00	0,00%	1,46	0,20%	132,39	17,96%	82,04	11,13%	487,21	66,10%	737,110	1,30	130,18
	1229	2017/09/26	2018/05/13	2018/07/09	530,00	25,00	4,78%	15,36	2,94%	0,00	0,00%	0,00	0,00%	0,00	0,00%	98,07	18,75%	92,87	17,76%	291,67	55,77%	522,960	0,99	98,67
	1230	2017/09/27	2018/04/18	2018/06/11	568,90	68,90	5,04%	40,61	2,97%	0,08	0,01%	0,07	0,01%	3,25	0,24%	254,18	18,61%	208,68	15,28%	790,04	57,84%	1365,805	2,40	240,08
	1252	2019/06/10																						
	1253	2019/06/11																						
	1254	2019/06/12																						
	1255	2019/06/13																						
	1256	2019/06/13																						
	Total Zone 2 = 30 BS				3 839,58	381,97	5,66%	216,88	3,21%	3,88	0,057%	8,72	0,13%	10,95	0,16%	1339,56	19,84%	935,66	13,86%	3854,37	57,08%	6751,995	1,76	175,85

Figure 43: Processing facility and laboratories at Akko. Top: Scrubber plant for the washing and liberation of sand-size sediment from clay aggregates. Middle: Two classification and jig plants. Bottom: Mineral final recovery laboratory where the sorting of minerals is done manually.

The jig supervisor carries the ultimate responsibility to ensure that the jigging system operates according to the specifications and procedures, that tracer tests are done as prescribed and the tracer recoveries are recorded. The recorded data are prepared and logged in line with the requirements stipulated in the SOP and passed on to the project manager.

The jig supervisor manually documents the jigging process: Start and finish times, tracers introduced, tracer tracking, taking photos, adding remarks (e.g. water flow changes, etc.). Density tracer tests are carried out with the use of cube-shaped epoxy tracers with specific gravities of 3.53 SG and sizes from 1mm, 2mm, 4mm, 6mm and 8mm. Density tracer tests are carried out on every jigging run to monitor the separating effectiveness of the pulsating jigs.

Samples in the 2mm-8mm size fraction are:

Visually inspected and sorted in the recovery laboratory.

Samples in the +8mm size fraction are:

Sorted by hand from a picking belt.

10.2.2 Mineral Sorting

Shefa Gems' staff is well-trained in the mineralogical identification of the Target Mineral Assemblage (TMA), including the Gem Box suite, the HIM suite and the pathfinder KIMs. The mineralogical identification focuses on KIMs such as Garnet (pyrope/eclogitic), Ilmenite, Spinel and Chrome-Diopside (CPX) in addition to the TMA minerals of diamond, rutile, sapphire, ruby, Carmel Sapphire™, natural moissanite, hibonite, garnet, ilmenite, spinel and Zircon. Laboratory staff records the data in the company's database, together with the original sample volume data.

Shefa Gems follows a set of SOPs for alluvial and soil/rock/stream prospecting samples in its laboratory. These procedures are conventional for diamond and precious stone exploration and similar to the best practices used by other exploration companies worldwide. Training and sorting efficiency were tested in the Shefa Gems laboratory with the addition and recovery of natural diamond tracers. This was accomplished on more than one occasion. Several diamond tracers were placed into samples for recovery efficiency testing (these tracers are natural diamond crystals with one polished face and a serial number). The sorters in the laboratory have demonstrated their efficiency in identifying and recovering diamonds, along with the rest of the TMA. The mineralogical testing will also continue to focus on the KIMs and TMA. All the other mineral descriptions are recorded and saved in the company's database.

11. Mineral Resource and Mineral Reserve Estimates

11.1 Introduction

This section describes the methods used to derive and classify the latest "Mineral Resource and Reserve" estimates for the Shefa Gems project. The Shefa Gems consulting geologist, Dr John Ward was responsible for the calculation of the volume figures. These calculations include the data obtained from the drilling to date. The resource estimation procedures were validated by Creo.

11.2 Geological interpretation

After 20 years of exploration in a "greenfields" terrain, Shefa Gems has established the presence of a Target Mineral Assemblage (TMA) in both primary Mesozoic and Cenozoic volcanic sources, and in Cenozoic secondary alluvial deposits in the Kishon River Valley. On Mt. Carmel and in the Ramot Menashe areas the TMA comprises four precious stones (diamond, moissanite (natural moissanite that is rare globally) sapphire, ruby, and five heavy minerals (corundum, zircon, rutile, ilmenite, and garnet) with an additional rare gem, hibonite

A robust "Source to Sink" geological model was developed in 2014 to guide placer exploration of the alluvial placer deposits developed in the Kishon River valley and to improve the understanding of the primary source emplacement of the TMA into this relatively short-reach fluvial system that terminates in a marine setting.

The extensive sampling yielded abundant KIMs such as garnet, ilmenite, spinel, clinopyroxene and rare diamond and also several varieties of corundum (notably Carmel Sapphire™, blue sapphire, ordinary sapphire and ruby). In addition, there was a significant amount of the rare natural moissanite (including the two largest natural grains recovered to date in the world, 4.1mm and 4.14mm) and zircon, ilmenite, hibonite and rutile were also recovered.

The primary sources of these minerals comprising the TMA are the ultramafic and mafic volcanoclastic rocks from Mt. Carmel (Upper Cretaceous in age) and the Yizre'el and Afula basins and their faulted margins (primarily Miocene in age). These primary sources were eroded by the Kishon River and its tributaries, driven largely by the Neogene uplift of Mt. Carmel and extrusion of basalts along the faulted margins of the Yizre'el and Afula basins. The erosional products from Mt. Carmel, and in particular those from the primary sources, were deposited in secondary deposits in the Kishon graben that was subjected to marine reworking at intervals during the Neogene at its distal end.

Exploration to date delineated a 4.5km long deposit in the Mid-Reach of the Kishon River where in places the TMA is sufficiently well concentrated to form placers. Consequently, a source-to-sink geological model has been developed for the Kishon catchment whereby the TMA is associated with a series of placers. Channel and terrace gravel of the palaeo-Kishon River Mid-Reach has been the focus of attention in this regard.

11.2.1 Mid-Reach Gravel Deposits

The valley-fill sediments, accumulated as Kishon River floodplain and terrace deposits, generally comprise a basal gravel layer of 2 - 4m thick overlain by a 3 - 6m thick dark-brown clay overburden. The gravel unit comprises cobble to pebble, rounded to sub-rounded, clast-supported gravel in a clayey sand matrix. Occasional boulders do occur.

11.3 Audit Procedures

Creo has independently verified the underlying sampling and assay data. Creo considers that, given the extensive sampling programme, geological investigations, check procedures and, in certain instances, independent audits, the estimates reflect an appropriate level of confidence.

The Mineral Resources and Reserves estimates use the terms and definitions as set out by SAMREC (2016). Furthermore, the Inferred Mineral Resources are not inclusive of those Mineral Resources modified to produce Mineral Reserves and therefore only a Mineral Resource will be considered.

11.4 Mineral Resource and Reserve Estimation Methodology

The resource block method of estimating the mineral resources was used on Zone 1 and Zone 2 in the Mid-Reach of the Kishon River valley. This represents an area of approximately 519 000m^2, a very small portion of the Mid-Reach and the permit area in total (Figures 44).

The estimation of resource blocks is not typical of a mining operation where the value of resource blocks is estimated and classified well ahead of the mining blocks presently being developed and mined. Because of the highly erratic nature of both the TMA mineralisation zones and of the grade within them, no attempt was made to evaluate this and merely a volume figure can be presented. No comment can be presented on the continuity of grade values within the mineralised horizons due to the limited data. The Mineral Resource block has been defined based on information obtained mainly during drilling. The gravel deposit geometry has been modelled using Golden Software's Voxler™ 3D modelling software. This software allows the three-dimensional structure of the mineralised volume to be viewed graphically.

11.5 Quality and Quantity of Data

In Zone 1, the exploration area between boreholes SY-65 to SY-109, drill lines were set out perpendicular to the valley and therefore the gravel body. Drilling was performed at 50m drill line intervals with an average of 5 boreholes per drill line. Borehole spacing in the drill lines averaged 25m.

Therefore, the spacing of boreholes was not on a definite grid. However, the layout of sample points was totally unbiased and not influenced by any geological considerations. The assay results were entered into a database from where the data was imported into the Voxler™ 3D modelling software where the data gets displayed spatially and ultimately a volume could be calculated.

11.6 Quality Assurance/Quality Control

Samples were treated at the Shefa Gems processing facility and laboratory in Akko, under the personal supervision of the management of Shefa Gems. Here the samples were crushed (if required), washed, screened, jigged and sorted. Standard operating procedures were followed with proper validation processes such as tracer testing being done routinely. The procedures followed are conventional for diamond and precious stone exploration and is based on best practices principles used in the gem industry.

The use of simple sample checks (tracers and marked gems such as diamonds with a polished facet) are used as a standard procedure by Shefa Gems to assess recovery standards.

Sample custody was done properly with detailed labelling of samples, good sample security and proper record keeping in place.

11.7 Tonnage Estimation

Zone 1 (Boreholes SY-65 to SY-137)

Shefa Gems re-evaluated the modelling by applying the average *in situ* density values to generate a tonnage estimate for the gravel units. The density value applied to the gravels of the Mid-Reach domain, Zone 1, represented by the area between boreholes SY-65 to SY-137 is 1.49g/cm^3 that was obtained during analysis of the gravel component of samples BS-1174 and BS-1175 with SG values of 1.0748 g/cm^3 and 1.922g/cm^3 respectively. This value is lower than the average of 1.8g/cm^3 for gravel samples elsewhere in the Kishon River floodplain. The 1.49g/cm^3 value is considered an appropriate value for the use in tonnage estimation of gravel in this particular section of the floodplain.

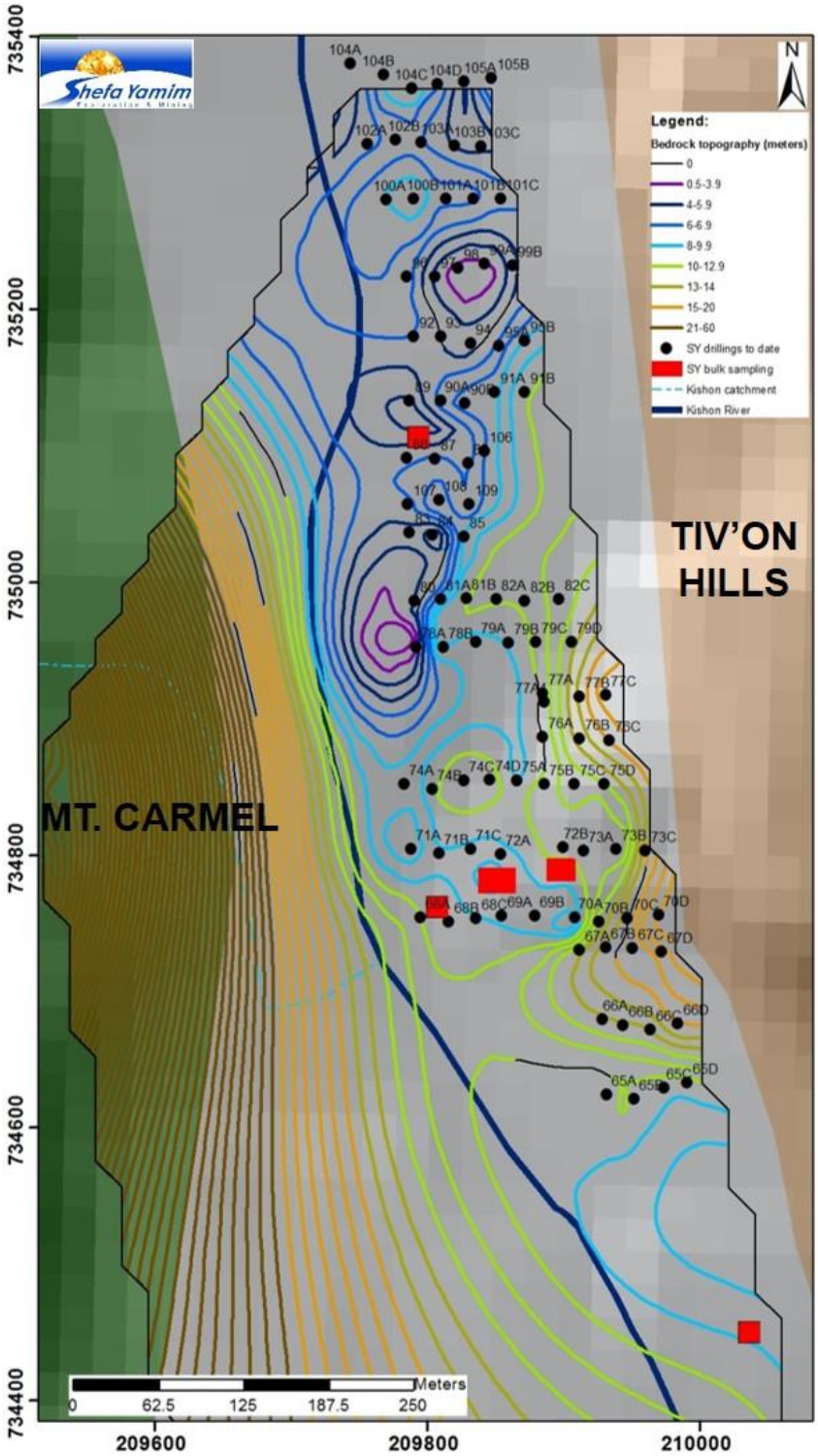


Figure 44: A map of the 191 500m^2 Inferred resource area between boreholes SY-65 and SY-109 at the Mid-Reach of the Kishon River valley showing the borehole locations and bedrock contours.

The total volume figure presented by the modelling of the Zone 1 gravel body was 627 000m^3 of gravel (boreholes SY-35 to SY-137). This gives a resource of 1 120 000t of TMA-bearing gravel overlain by 1 930 000 Mt overburden in Zone 1 in this part of the Kishon River Mid-Reach.

Zone 2 (SY-982 area)

Preliminary tonnage estimations for overburden and gravel layers were done based on confirmed polygons of high confidence, where dense spaced drilling and bulk samples were done.

Total area of calculation: 269 000m^2

Overburden estimated tonnage: 1 698 000t

Gravel estimated tonnage: 873 000t

11.8 Mineralisation

11.8.1 Exploratory Data Analysis

Exploratory data analyses are the application of various statistical tools to characterise the statistical behaviour or grade distributions of the data set. In this case, the objective is to understand the population distribution of the grade elements in the various units using such tools as histograms, descriptive statistics, and probability plots.

Of the 42 Kishon River Mid Reach pit and bulk samples mined 39 were treated at the in-house processing facility; 13 from Zone 1 and 26 from Zone 2. Samples sizes in Zone 1 ranged from 600 ton per sample to 123.5 ton per sample. In Zone 2 the sample sizes range from 690 ton per sample to 10 ton per sample. Three of the samples collected in Zone 2 is still being processed.

11.8.2 Assays

A total of 9,284 tonnes have been analysed by the Shefa Gems in-house processing facility and laboratories for TMA including the Gem Box suite and HIM suite mineral content. All the samples treated yielded KIMs, TMA and a considerable proportion of the Gem Box mineral suite (runs at >95% Gem Box suite). The Gem Box mineral suite was shown to be present in all the pit and bulk samples processed to date with some variation in yield, probably attributable to the smaller sample sizes and would therefore result in large variation in grade figures, but some useful trends could be seen here (Tables 6 & 7).

In both Zone 1 and Zone 2 Spinel dominated the gem mineral population representing 41% and 56% of the total population in the two areas respectively. Carmel Sapphire™ with a recovered grade of 26% was the second most common gem stone in Zone 1 followed by Garnet in the third place at 22%. In Zone 2 Garnet took up second place at 20% after Spinel whereas the recovered grade of Carmel Sapphire™ was 3% (Figures 46c & 46d).

Sapphire makes up 2.94% in Zone 1 and 5.21% in Zone 2.

Ruby makes up 0.054% in Zone 1 and 0.053% in Zone 2.

Moissanite makes up 0.07% in Zone 1 and 0.12% in Zone 2.

Hibonite makes up 0.21% in Zone 1 and 0.15% in Zone 2.

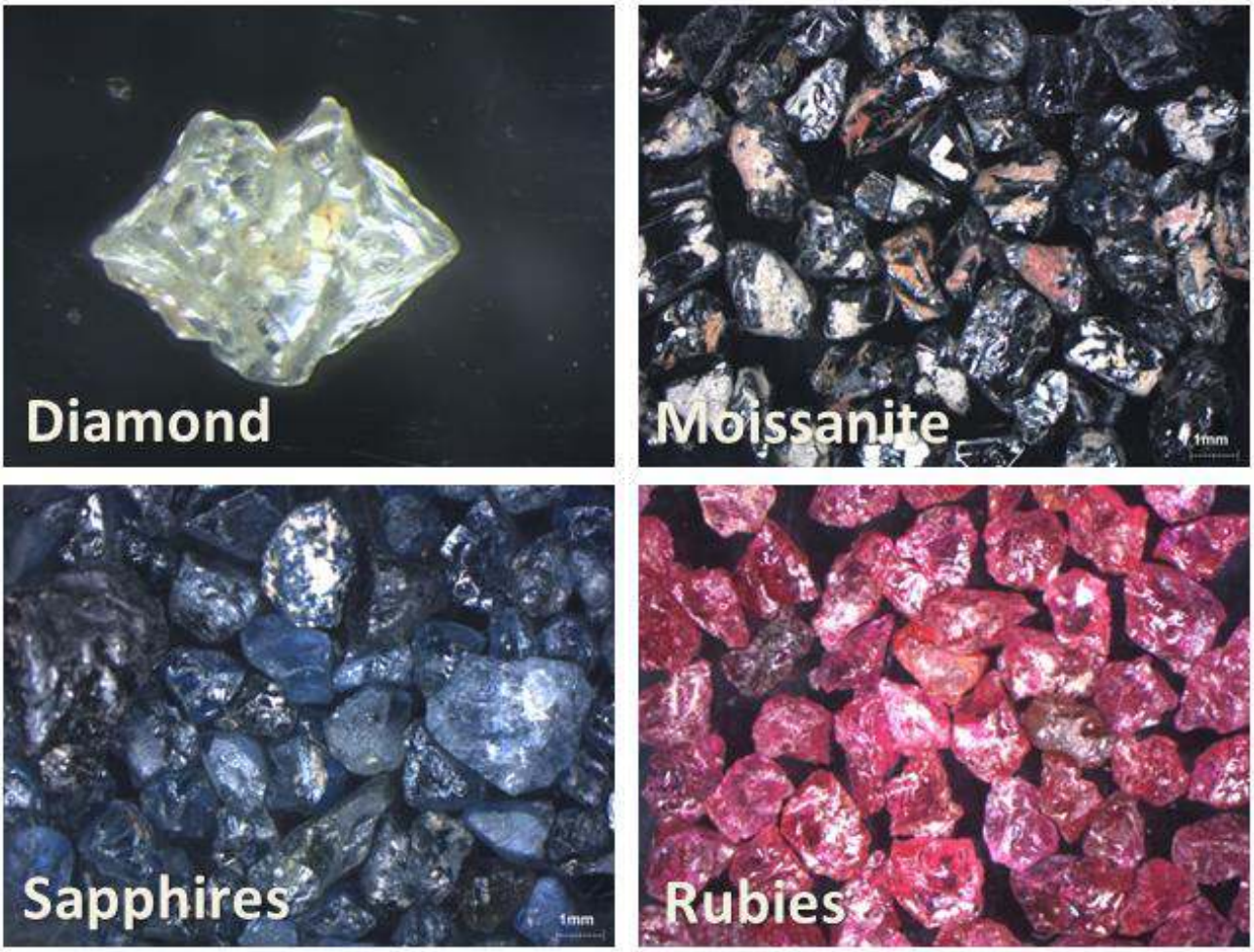


Figure 45: The gem variety TMA precious stones, from left to right – diamond, moissanite, sapphire and ruby recovered from the Kishon River gravels.

All in all, diamonds are present in the Kishon catchment, but are rare. Shefa Gems recovered 77 diamonds from its permit areas of which 76 are alluvial diamonds from the Kishon River valley

and one micro diamond found by De Beers geologists in an approximately 260kg sample they collected from the Rakefet Magmatic Complex. One diamond was found in borehole SY-18 in the Kishon River Mid-Reach.

The recently discovered hibonite crystals represents a sizable proportion of the gemstones in the samples and due to its high status in the gem industry, it should make a sizable contribution to the overall value of the gem suite. However, quantitative data on the hibonite occurrence is not available yet, but it is estimated to be at least a few percent of the total gem assemblage.

11.8.3 Grade Profile

The pit and bulk sampling data show how there is a level of variation across the modelled gravel bed. The variation between pits and bulk samples is well documented (Table 6 & 7), but Creo notes that the grade of recovered gemstones and gem populations varies considerably and is probably a function of sample size and the nugget effect of semi-mobile bar gravel trapsites on an incompetent footwall.

As the sampling data show, there is a high degree of variation between the individual pits and bulk samples, and between areas within the deposit. There is also variability present in the total gemstones recovered, and the splits between different gemstone populations.

The final gemstone grades were derived from the average undiluted grades presented in Table 6 & 7 for use in the Mineral Resource reporting has been taken at zero-cut-off values.

11.8.4 Spatial Analysis

A detailed geostatistical analysis of the composited basal gravel was undertaken by Creo in order to identify any spatial continuity. Due to the lack of variability and limited data, no variogram structures could be modelled for the various gemstone suites. Creo therefore chose to model using the inverse distance squared estimation methodology. Good correlation was observed between the sample points with definite continuity between bulk and pits sample locations.

11.8.5 Gem Box Suite and Heavy Industrial Mineral Suite Minerals size frequency distributions

During the bulk sampling campaigns, the size frequency distributions (SFDs) of the TMA were collected, based on the carater/grainer/sieve method. This method is a combination of mass (in carats) size intervals and sieve (hence shape related) intervals used more conventionally in the diamond industry where the rough is sold in these categories and thus revenue per mass/size class can be readily obtained. Shefa Gems adapted this method slightly, allocating the intervals

to “Groups” and combining the sieve size intervals of the <0.65 carats, i.e. +11 diamond sieve, +9 diamond sieve, + 7 diamond sieve and + 5 diamond sieve into their Group 1 which represents the smallest size fraction but invariably the biggest carat class per mineral species (Table 8).

Table 8: Shefa Gems mass/size classification used for each mineral species in the Gem Box Suite and Heavy Industrial Mineral Suite.

SHEFA GEMS CLASSIFICATIONS	
DIAMOND MASS/SIZE CLASSES	SHEFA GEMS GROUPS (Mass/Size)
+ 10.8 cts ("Specials")	16 ("+10.8 ct Specials)
10 cts	15
9 cts	14
8 cts	13
7 cts	12
6 cts	11
5 cts	10
4 cts	9
3 cts	8
10 gr	7
8 gr	6
6gr	5
5gr	4
4gr	3
3 gr	2
<0.65cts	1
Antwerp +14 (DTC +11)	1A (0.37 - 0.65 cts/stn)
Antwerp +12 (DTC + 9)	1B (0.21 cts/stn)
Antwerp +10 (DTC + 7)	1C (0.12 cts/stn)
Antwerp -10 (DTC -7)	1D (<0.1 cts/stn)

Table 9 provide the size frequency distributions for the total TMA combined for Zones 1 and 2. Significantly, the total TMA carats generated by the bulk sampling from Zone 1 (6,384 tonnes) and Zone 2 (3,840 tonnes) amount to some 16,631 carats to give an overall recovered grade of about 162 cpht from the total of 10,224 tonnes processed (at a bottom cut-off of 1mm).

As is evident, the Kishon Mid Reach Placer is a multi-commodity alluvial deposit that demonstrates geological continuity and well-constrained volume, relative density and grade determinations, although, these Exploration Target carats warrant further classification to Resource categories of Inferred and Indicated Resources at the overall TMA scale and also per individual mineral species scale (De Wit, *et al.,* 2019).

Table 9: The Size Frequency Distribution for the total TMA combined from Zone 1 and Zone 2 (North).

SHEFA GEMS SIZE CLASSIFICATION: TOTAL TMA, Zone1 and Zone 2 (North), 2019; GEM BOX SUITE & HIM SUITE COMBINED		
INTERNATIONAL DIAMOND MASS/SIZE CLASSES	SHEFA GEMS GROUPS (Mass/Size)	Total TMA - Zone 1 & 2 N (carats)
+ 10.8 cts ("Specials")	16 ("+10.8 ct Specials)	88,47
10 cts	15	0,00
9 cts	14	0,00
8 cts	13	16,11
7 cts	12	7,72
6 cts	11	19,12
5 cts	10	46,39
4 cts	9	20,48
3 cts	8	85,81
10 gr	7	25,26
8 gr	6	151,04
6gr	5	246,12
5gr	4	248,65
4gr	3	478,18
3 gr	2	543,71
<0.65cts	1	14 654,10
TOTAL CARATS		16 631,16
TOTAL TONNES		10 224
OVERAL SAMPLE GRADE (cpht) at 1mm BSS		162,67

Size Frequency Distributions shows that all the conventional size ranges are present, except for the 9 caraters and the 10 caraters, with the peak (88%) in the Group 1 category (<0.65 cts/stone down to about the 0.12 cts/stone average size).

11.8.6 Gemstone prices

Dr. Gavrielov Gila an expert gemmologist conducted an independent evaluation on the gemstones of Shefa Gems. Dr Gavrielov has over 40 years of expertise and experience in the appraisal and purchase of precious stones for use in jewellery. Highlights of her career include joint ventures with Rapaport and the British Gemmological Institute (BGI) evaluating gemstones, diamonds and jewellery. She has also established a jewellery design business. Table 10 summarises the average cut and polished prices per carat assigned to the gem suite by Dr Gavrielov.

Table 10: The average prices per carat for each mineral.

Independent valuation of stones in Shefa Yamin's Gem Box	
Shefa Yamin Gemstone	**Cut & Polished price per carat (US$)**
Natural Moissanite™ (rough only > 4mm))	10,000
Blue Carmel Sapphire™ (Cabochon cut)	7,000
Black Carmel Sapphire™ (Cabochon cut)	5,000
Hibonite	1,000
Sapphire	500
Ruby	500
Spinel	150
Ilmenite	105
Garnet	50
Zircon	100
CPX	45
Mix KIM's (Garnet, ilmenite, spinel, CPX)	30
Rutile	25

The main purpose of the evaluation of Shefa Gems' stones was to provide a professional opinion regarding the value of the suite of precious stones recovered during exploration carried out by the Shefa Gems in the Kishon Mid-Reach alluvial deposit. This is particularly significant as there are two unique and rare minerals found in the Gem Box suite of precious stones, Natural Moissanite™ and Carmel Sapphire™.

The Natural Moissanite™ found by the Company, is the largest in both volume and size ever found globally (single crystals up to >4mm). The Carmel Sapphire™ is not found anywhere else in the world and is formed of the rare mineral Carmeltazite, a newly discovered mineral internationally recognised by the International Mineralogical Association Commission on New Minerals, Nomenclature, and Classification.

Dr Gavrielov comments that:

"This "Gem Suite" comprises extremely rare and unique minerals that to-date have not been found on earth. These are Natural Moissanite™ (SiC - Diamond Plus), which were discovered by the company during exploration activity in the largest quantities and sizes in the world (as published by the GIA in August 2014). In addition is the Carmel Sapphire™ (already a registered trade mark by the company) and the Carmeltazite within the Carmel Sapphire™ - a completely

new mineral recognized as such by the IMA Commission on New Minerals, Nomenclature, and Classification. It can only be found in the Holy Land.

She further states: "In my opinion, not only are the gems singular in their rarity and origins in the Holy Land, but the mine life is limited to an approximated 15 years maximum. This limited availability adds to the value of the gemstones."

Shefa Gems initiated a trial marketing initiative in collaboration with Yossi Harari a world-renowned jewellery designer with 30 years in the trade and three-time winner of the Couture Design Award. The handmade jewellery is created from 24 Karat gold, 'gilver' (Harari's own trademarked metal alloy that combines oxidized silver and 24 Karat gold) and Shefa Gems' precious gemstones. The gemstones used include the Carmel Sapphire™, Natural Moissanite™, black spinel, ilmenite, garnet, sapphire, hibonite and ruby (Figure 46). The jewellery was hand-crafted using ancient goldsmithing techniques and developed in Yossi Harari's atelier in Istanbul (Figure 47 & 48).

11.8.7 Valuation Estimations For The Gem Box Suite Rough From Polished Prices

The revenue (US$) per carat per mineral species and for the total TMA is required in order to upgrade the Exploration Results to a level where these can be assessed for levels of confidence applicable to the Resource category. The Kishon Mid Reach Placer hosts at least 8 Gem Box Suite minerals, some of which have reasonable prospects of eventual economic extraction (RPEEE) and their combined overall TMA likewise demonstrates potential for RPEEE.

Shefa Gems is in the process to further pursue a “Mine to Market” sales strategy that has been tested provisionally earlier in the 2019 “Heaven on Erath” jewellery collection. However, no direct sales of the rough for both the Gem Box Suite and the HIM Suite minerals are available. Consequently, the polished prices published by several vendors selling cut and polished goods of the eight Gem Box Suite minerals have been used as a starting point to work back to a potential rough revenue estimate (USD/ct) per mineral species and also for the overall TMA. The combination of the value grades and revenue per size fraction in turn allow for the calculation of the potential contained revenue in USD per tonne. Therefore, three main aspects are covered in this section: value grade per mass/size class (cpht), revenue per mass/size class (US$/ct) and potential *in situ* / contained revenue per tonne (US$/t).

During the modelling back from “polished” to “rough”, the following assumptions were made: -

1. The combined Zones 1 and 2 carats have been used with value grades for each respective size fraction.
2. Polished prices were sourced for the Gem Box Suite minerals from vendors displaying the prices on the internet, except for the new and to date, unique, Carmel Sapphire™ polished prices that were derived from Dr Gavrieloa Gila’s assessment in March 2019.
3. The polished prices of all gems were worked to 15% of the polished prices, except for Carmel Sapphire™ that was taken back to 7.5% because this is a new sapphire with blue, black and dark brown to dark grey hues that have yet to be tested comprehensively in the market.
4. A further discount was applied for the size classes smaller than a carat, based on actual proportions achieved from January – August 2019 diamond sales in Antwerp from a single supplier. The database was in excess of 150,000 carats with the attendant, actual sales prices achieved. The factors used were: -

    i. Group 2 / 3 grainers: **0.69**.
    ii. Group 1A / +11 DTC sieve: **0.4.**
    iii. Group 1B / +9 DTC Sieve: **0.29.**
    iv. Group 1C / +7 DTC sieve: **0.21.**
    v. Group 1D / -7 DTC sieve: **0.16.**

Table 11 summarises the results of the value grades, revenue per cart and revenue per tonne for each individual Gem Box Suite mineral and the overall gem TMA, combined for Zones 1 and 2 (North). The overall revenue per tonne is some $41/t. As the Kishon Mid Reach Placer is a multi-commodity alluvial deposit, from which all placer minerals would be extracted by the mining and process methods, the overall TMA is based on 16,000+ cts with estimated rough values.

Table 11: Summary of the Gem Box Suite of minerals and total gem TMA for grade (cpht), average price of rough (US$/ct) and revenue contribution per tonne (US$/t).

SHEFA GEMS: KISHON MID REACH PLACER GEM MINERAL ROUGH VALUATION ($/ct) & REVENUE/TONNE ($/t), NOVEMBER 2019								
GEM MINERAL SPECIES	ZONE 1 + 2 (North) Tonnes (t)	ZONE 1 + 2 (North) Carats (cts)	Average Recovered Grade (cpht) at BSS = 1mm	Revenue per Tonne (US$/t)	Average Polished Price per carat ($/ct)	Average Rough Price per carat ($/ct)	SAMREC 2016 Resource Category based on Carats	REFERENCE FOR POLISHED PRICES
Spinel	10 244	7 807,28	76,21	0,25	4	1	Inferred (Indicated pending)	Align Research (except used coloured spinel); Dr Gavrielov (except used origin to upgrade price); Gem Select values for Black Spinel used
Garnet	10 244	3 516,32	34,33	0,16	38	6	Inferred (Indicated pending)	Align Research; Dr Gavrielov; Gem Select
Carmel Sapphire™	10 244	2 729,71	26,65	35,86	4 582	357	Inferred (Indicated pending)	Dr Gavrielov
Ilmenite	10 244	1 705,52	16,65	0,80	290	48	Inferred	Align Research; Dr Gavrielov; Manchester Minerals
Sapphire	10 244	669,25	6,53	1,61	585	98	Inferred	Align Research; Dr Gavrielov; Gem Select
Hibonite	10 244	31,83	0,31	0,36	1 368	208	Exploration Target	Dr Gavrielov; Gem Gazer; Align Research (used a lower value)
Natural Moissanite™	10 244	15,37	0,15	1,50	794	111	Exploration Target	Dr Gavrielov provided a rough price of US$10,000/ct (but adapted back to Group 1
Ruby	10 244	9,18	0,09	0,04	281	44	Exploration Target	Align Research; Dr Gavrielov; Gem Select
TOTAL GEM TMA	10 224	16 484	161	41			Inferred	

The overall Gem Box Suite, therefore, was given a contained rough revenue of US$41/t, dominated by the Carmel Sapphire™ at about US$35/t because of its high intrinsic value (including large stones) and comparatively good grades.

No rough price estimates are available for the Gem Box Suite in the public domain and thus prices were back calculated at 15% of the polished prices available from Dr Gavrielov and Align Research' estimates. Align derived their values largely from traders/vendors that we also followed up on via their internet sites. Prices estimated in this manner are relatively consistant with the only major anomaly being that of Spinel, where the Shefa Gems stimated average price of $4/ct is considerably lower than Dr Gavrielov's $150/ct and Align Research's $70/ct average. However, this discrepancy is explained by the fact that the Kishon Mid Reach Placer Spinels are the black variety that "command" only 8-10% of the prices given to the fancy coloured varieties that were used by Align Research in their estimate. Dr Gavrielov's estimate also included the upside provided by the certifiable origin of the "Holy Land" – a process that has not been applied in any of these rough estimations by Shefa Gems.

On the Natural Moissanite, the estimated rough price of US$10,000/ct given by Dr Gavrielov was discounted to US$1,000/ct because all the bulk sample results fall into the extra fine, Group 1 category where the smaller sizes are expected, individually, to attract lower revenues. The rest

of the rough estimations by Shefa Gems and its consultants fall well within, or even above, those used by Dr Gavrielov and Align Research. Significantly, the overall TMA has been raised from Exploration Result status to an Inferred Gemstone Resource category, as have been the individual minerals Spinel, Garnet, Carmel Sapphire™, Ilmenite and Sapphire. The remaining, mostly low grade minerals of Hibonite, Natural Moissanite™, Ruby, Zircon and Rutile will remain in Exploration Results status (Geological Target) until >450 cts each have been generated and, preferably, valuated in the rough (Dr John Ward pers. comm.).

12. Mineral Resource Statement

12.1 Introduction

This section describes the status of the Shefa Gems project in terms of its classification into an appropriate resource category and describes the methods used to derive and classify the current Mineral Resource and Reserve estimates for the Kishon Mid-Reach Zone 1 and Zone 2. The statement is based on the Gem Box Suite portion of the TMA only and excludes the Heavy Industrial Mineral Suite. Creo was not responsible for the actual calculation of the Mineral Resource and Reserve figures but verified the validity and accuracy of these calculations.

12.2 Audit Procedures

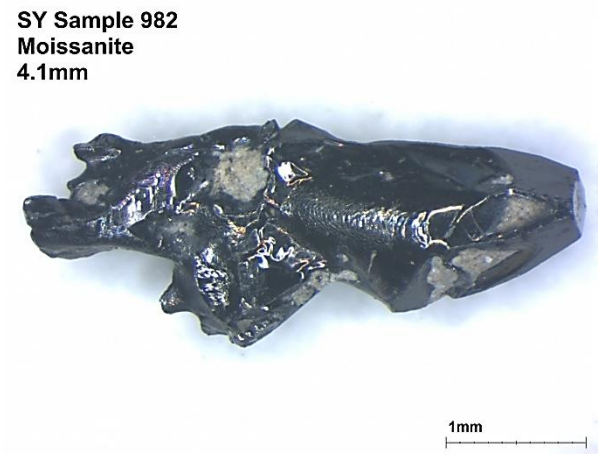
Creo has independently verified the underlying sampling and assay data. Creo considers that given the general sampling program, geological investigations, independent check grade estimates and, in certain instances, independent audits, the estimates reflect an appropriate level of confidence. This Mineral Resources and Reserves estimate use the terms and definitions as set out by SAMREC.

Further, the Inferred Mineral Resources are inclusive of those Mineral Resources modified to produce Mineral Reserves.

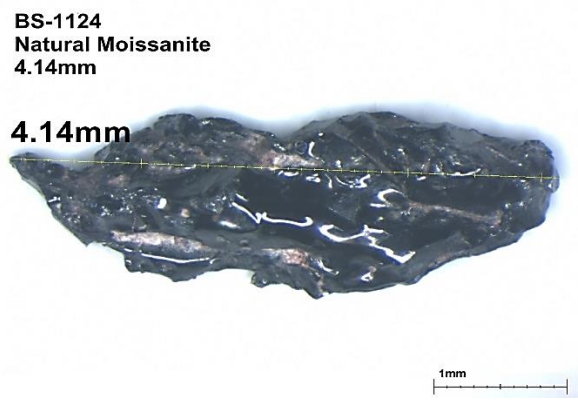
12.3 Resource Statement

12.3.1 Mineral Resource

For the Shefa Gems permit area or any portion thereof to be considered a Mineral Resource it must be an occurrence of gemstones of economic interest in such form, quality and quantity that there are reasonable and realistic prospects of gemstone extraction for the jewellery market. Here, location, quantity, grade, continuity and other geological characteristics of this mineral resource should be known, estimated from specific geological evidence and knowledge.

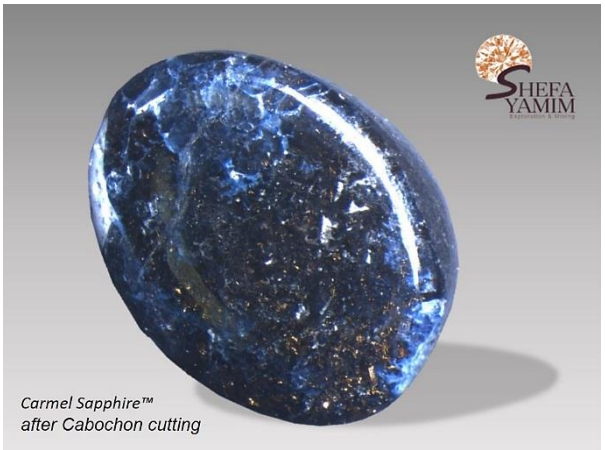


A: A 4.1mm long moissanite crystal found in Bulk Sample BS-982



B: 4.14mm long moissanite crystal found in Bulk Sample BS-1124

C: Carmel Sapphire™ crystal with volcanic glass crust - found in Bulk Sample BS-1124



D: Carmel Sapphire™ after removal of the volcanic glass crust and a basic polish

Figure 46: Examples of gems found in samples BS982 and BS-1124.

Figure 47**:** Hand crafted jewellery by Yossi Harari with gems from the Kishon River Mid Reach.

Figure 48: The collection, titled "Heaven on Earth", includes 11 necklaces, 10 rings, 4 pendants, 4 pairs of earrings and 2 bracelets. Harari had originally planned to create 18 pieces but created an additional 13 pieces as a result of the variety, sizes and quality of Shefa Gems' gemstones ability to be adapted in such a wide range of jewellery. The prices per piece for each set of jewellery in this collection ranges from $1,000 to $85,000.

12.3.2 Mineral Resource Classification

Classification of the Mineral Resources reflects the inherent variability in the distribution of economic concentrations of gemstones in alluvial deposits. Sampling gemstone bearing alluvial deposits necessitates bulk sampling because standard drilling techniques are inappropriate to

provide sufficient data density to enable estimation of tonnages and grades. Conventional drilling as currently employed can only provide information to determine the volume of the mineralised gravel units, and the locations relative to other facies assemblages and geological features such as floor topography. Derivation of Mineral Resources is largely dependent on the spatial distribution and density of bulk sample locations.

A number of assumptions were therefore made during the geological modelling process. Based on the available data, Creo has assumed that the gravel units remain constant to extents of the modelled units with no significant changes in riverbed morphology, gravel particle size distribution and valley gradient. Similarly, Creo has assumed that there is no significant change in the placer development laterally or with depth. Creo has also assumed that the distribution of different gemstones is relatively constant through the modelled units. Creo notes that the bulk sampling data indicates that there is a degree of variation in the gem mineralisation between samples. This is a key aspect which requires additional understanding.

Grade data are sourced from bulk sampling data as no direct grade estimate from drilling can be undertaken. Grade estimates are therefore entirely dependent on bulk sampling data for validation. The global grade has been applied to the gravel units, as described. Creo considers that understanding the Kishon paleo-drainage regime, which has influenced the mineralisation in particular, is key to understanding the grade and quality variability within the gravel bed. This will also influence the gravel bed morphology. Creo considers that the above assumptions, in particular the distribution of gemstones within the gravel bed units, along with other aspects such as the assumed density are key factors in determining the classification applied to the Mineral Resources.

12.4 Mineral Resource Statement

The Mineral Resource statement for Zone 1 and Zone 2 in the Kishon River Mid-Reach deposit is presented in Table 12. The statement is split into the two zones based the different geographical areas and only considers the gemstone fraction of the Gem Box Suite, excluding the Heavy Industrial Minerals. The statement presented is based on the geological modelling of the two zones and the application of factors derived from the bulk sampling. Creo considers that Table 12 as presented is reported in accordance with SAMREC (2016). In presenting this Mineral Resource, the following apply:

Mineral Resources are quoted at appropriate in situ economic cut-off grades which satisfy the requirement of ‘potentially economically mineable’ for open-pit mining; furthermore, the

commodity prices incorporated into the cut-off grade calculations for derivation of optimised shells are USD10 /ct which is an average price for lower value gemstones per carat recovered.

With a sufficient amount of data points available resource estimation was done based on surface measurements and extrapolation through triangulation principles which classifies the Zone 1 and 2 in the Mid-Reach of the Kishon River valley as a **Mineral Resource.** Here the occurrence of gemstones of economic interest in such form, quality and quantity that there are reasonable and realistic prospects of gemstone extraction for the general consumption in the jewellery market.

Sample location, quantity, grade, continuity and other geological characteristics of this mineral resource is known, estimated from specific geological evidence and knowledge. The sample coverage could demonstrate grade continuity with a high degree of certainty and was therefore classified as an **Inferred Resource**.

Zone 3 is not to be included in the Mineral Resources of Shefa Gems, instead it considered a Geological (Exploration) Target for which tonnage, densities, shape, physical characteristics, grade and mineral content cannot be estimated with a reasonable level of confidence at this stage.

12.4.1 Previous Mineral Resource Statements

No previous Mineral Resource statement has been declared for the Shefa Gems Project.

12.4.2 Current Mineral Resource Statement

The statement in Table 12 presents the total estimated resources and reserves for the Kishon Mid-Reach in-situ deposits.

Table 12: Mineral Resource and Mineral Reserve statement for the Kishon Mid-Reach Zone 1 & 2 deposits at a zero cut-off grade (27 September 2019).

Mineral Reserve Category				Mineral Resource Category			
Classification	Zone	Tonnage (t)	Grade ct/100t	Classification	Zone	Tonnage (t)	Grade ct/100t
Total Probable		0		Inferred	1	1 120 000	152.44
		0		Inferred	2	873 000	175.85
Total Reserves				Total Inferred		1 993 000	162.69

12.5 Creo Comments

Creo considers that the quality of the drilling, sampling, sample preparation and sample handling to be of a high standard. The number of boreholes and in particular the spatial distribution and volume of samples is sufficient to delineate a Mineral Resource to the level of confidence required by SAMREC to classify both the Shefa Gems exploration targets as Mineral Resources. Both the Zone 1 and Zone 2 areas in the Mid-Reach section of the Kishon River valley are classified as Inferred Mineral Resources.

Zone 3 requires drilling and bulk sampling to provide the confidence in grade and grade continuity needed to bring this area into a SAMREC resource status. Creo considers there to be a fair potential for the delineation of Mineral Resources and Mineral Reserves at Zone 3 following ongoing exploration and development. The Shefa Gems exploration programme includes an annual revolving drilling and sampling budget to investigate the extensions to known TMA deposits inside and outside of the currently defined exploration area.

This cautionary approach in the declaration of mineral resources and mineral reserves is a consequence of the inability to predict even over short distances the extent and grade of the deposit due to the complex sedimentological controls of the mineralisation and the correct interpretations thereof. Fluvial deposits, by nature, are notorious for their absence of lateral continuity. The approach used by Creo to derive at these conclusions is generally considered to be appropriate to these types of deposits and are in line with generally accepted norms and standards.

Creo supports Shefa Gems' ultimate objective to develop the Rakefet Magmatic Complex , the primary source of the GEM Box to its full potential once the company has established a proper mining operation at the Kishon Mid-Reach.

13. Conclusions and Recommendations

Creo Design (Pty) Ltd has completed a CPR at the request of Shefa Gems Ltd. regarding the Shefa Gems Mineral Exploration Project in northern Israel, using all available data up to August 2019. Shefa Gems is currently in an advanced stage towards the delineation of Mineral Resources and Mineral Reserves at Zone 3 in the Kishon River Mid-Reach Multi-Commodity Placer. This target area is being developed in parallel with encouraging exploration advances achieved at the kimberlitic sources (primary sources for gem minerals) on Mt. Carmel and along the Lower Galilee valleys' margins.

Creo is of the opinion that Shefa Gems' exploration projects are managed by professionally skilled and technically competent personnel. A comprehensive and well-managed work programme covers aspects ranging from mapping, drilling and sampling in the field to the final recovery and identification of minerals at a laboratory. Shefa Gems has a well-equipped operational centre at Akko, which houses a state-of-the-art treatment facility and laboratory. Due to the recent progress of the company whereby its exploration campaign has advanced to the evaluation phase, it up-scaled the operational capacity to facilitate the treatment of large samples and started with the inception of a trial mining phase. In doing so the company deploys a range of exploration and evaluation techniques, which are not only universally applied, but are tested and proven in mineral exploration has been, and is continued to be employed by Shefa Gems.

The company's exploration programmes are designed and managed according to SAMREC principles and aligned to international standards for responsible reporting of exploration results, mineral resources and mineral reserves. The programmes and methodology are continually assessed by an international team of experts specialising in mineral exploration and precious stones to ensure compliance with the reporting code. By adhering to first principles of exploration and applying a systematic approach, programmes have been designed to improve confidence in results and lower risks and uncertainties. In keeping with transparency and integrity, Shefa Gems' geological models, based on exploration results, are presented to the science-based fraternity for peer review at conventions, conferences, through publications and collaborations with renowned earth-science specialists at various universities.

Based on the work to date, Creo considers the data collection procedures applied during the sampling phase appropriate and the sample database suitable for resource estimation and work can progress on this level. Creo believes that the drilling, pitting and bulk sampling done in the Zone 1 and Zone 2 target area are sufficient for delineating an Inferred mineral resource.

The overall Gem Box Suite has a contained revenue of US$41/t, dominated by the Carmel Sapphire™ at about US$35/t because of its high intrinsic value (including large stones) and comparatively good grades. Shefa Gems is about to embark on a trial mining campaign and to this end it has already completed a Technical Economic Evaluation and is in an advance stage of planning and development of its trial mining phase.

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15. DATE AND SIGNATURE PAGE

Johan Hattingh

I, Johan Hattingh of Stellenbosch, South Africa, do hereby certify that as the author of this Updated Competent Person's Report on the Shefa Gems Ltd Gemstone Assets, dated November 2019, hereby make the following statements:

I am a Principal Resource Geologist with Creo Design (Pty) Ltd. with a business address at Unit 17, 9 Quantum Street, Techno Park, Stellenbosch, South Africa. I am a graduate of Stellenbosch University (B.Sc., 1985; B.Sc. Hons., 1988) and University of Port Elizabeth (M.Sc., 1992; Ph.D. Geology, 1996).

I am a member in good standing of the Geological Society of South Africa and I am registered with The South African Council for Natural Scientific Professionals (Registration #400112/93).
I have practiced my profession in the mining industry continuously since graduation.
I did visit the property during 2006, 2007 and again in November 2015.

I have read the definition of "Qualified Person" set out in SAMREC and certify that, by reason of my education, affiliation with a professional association (as defined in SAMREC), and past relevant work experience, I fulfil the requirements to be a "Qualified Person" for the purpose of SAMREC. My relevant experience with respect to resource modelling includes 29 years' experience in the mining sector covering exploration geology, mine geology, grade control, and resource modelling. I was involved in numerous projects around the world in both base metals and precious stone and metal deposits.

I am responsible for the entire content of this technical report titled "Updated Competent Person's Report on the Shefa Gems Ltd Gemstone Assets", dated December 2019.

I have no prior involvement with the property that is the subject of this Technical Report. As of the date of this Certificate, to my knowledge, information, and belief, this technical report contains all scientific and technical information that is required to be disclosed to make the technical report not misleading.

Signed and dated this 2nd day of December 2019.

J. Hattingh
Ph.D. Geology, Pr. Sci. Nat.