2-D SEISMIC REFLECTION INTERPRETATION OF LINE 856-SGR-58 & 846-SGR-50. ROCK PHYSICS ANALYSIS FOR RESERVOIR CHARACTERIZATION & PETROPHYSICAL ANALYSIS OF LOWER GORU BY MAKING CROSS-PLOTS USING WELL DATA

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2009-2011

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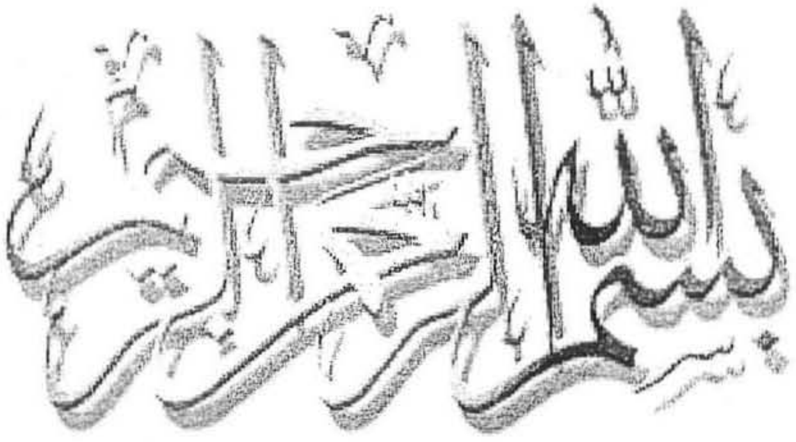
IT'S BECAUSE OF ALLAH!!



"In The Name of ALLAH, the Most Merciful & Mighty"

"PAY THANKS TO ALLAH EVERY MOMENT AND GO TO EXPLORE THE HIDDEN TREASURES, ITS ALL FOR YOUR BENEFIT".

CERTIFICATE

This dissertation, submitted by **MUHAMMAD SHAKEEL** S/O **MIRDAD KHAN** is accepted in its present form by the Department of Earth Sciences, Quaid-i-Azam University Islamabad as it satisfies the requirement for the award of M.Sc degree in Geophysics.

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2009-2011

DEDICATION

My whole thesis work is dedicated to my Parents, Brothers, Sister, Teachers & my
Friends who encouraged me and
all those who love me and whom I love.

ACKNOWLEDGEMENT

All praises for Almighty ALLAH, the most beneficial, the most merciful compassionate creator of the universe, Who blessed me with the knowledge and enabled me to complete this research work.

All respect to Holy Prophet Hazrat Muhammad (P.B.U.H) who appeared and blossomed as model for whole of humanity.

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ABSTRACT

The Seismic lines 856-SGR-56 & 846-SGR-50 were given for study. To investigate the lateral and vertical variations of velocity within a layer average velocity and Iso-velocity graphs were prepared. Four reflectors and normal faults are marked.

To see reflectors positions and to study their nature, seismic time and depth sections were prepared which shows Horst & Grabon structures which may be favourable for hydrocorbon. Time and depth contour maps of Basal Sand are also prepared.

A descriptive analysis of Rock Physics using TD and RHOB Log Data of DHAMRAKHI#1 well has been made. Rock Physical Properties (e.g. P-wave Impedance, S-wave Impedance, Poisson Ratio, Bulk and Shear Modulus, etc) are calculated for a particular zone whose depth ranges from 2000m to 2900m. Actually this analysis is made to seek for the hydrocarbon potential zone using cross plots of different physical properties as mentioned above. These properties (P-wave Impedance, S-wave Impedance Bulk and Shear Modulus) were found high in sand ,that must be low in reservoir No reservoir zone was identified.

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CHAPTER NO:1 INTRODUCTION

CHAPTER NO:2 GENERAL GEOLOGY &TECTONIC

CHAPTER NO:3 ACQUISITION & PROCESSING

CHAPTER NO:4 SEISMIC DATA INTERPRETATION

1.1 INTRODUCTION

The area of study is lying in Southern Indus Basin in Sindh province(Sanghar). Sanghar, is a small city roughly 35 miles (56 km) east-south-east of the city of Nawabshah and the same distance north of Mirpur Khas.

Map of Sanghar is shown in Fig:1.1. Two seismic lines 856-SGR-58 and 846-SGR-50 were provided by the department of Earth Sciences Quaid-I-Azam University Islamabad, in order to interpret the seismic sections along the given seismic lines.

a) LATITUDE OF THE AREA

Latitude of the area is 26°, 19', 00" N to 26°, 24', 00" N

b) LONGITUDE OF THE AREA

Longitude of the area is 69°, 00', 00" E to 69°, 05', 30" E

Fig :1.1 Map showing the location of area of interest (www.googlemaps.com)

1.2 BASE MAP

Base map is shown in Fig:1.2 on which primary data and interpretations can be plotted. A base map typically includes locations of concession boundaries, wells, seismic survey points and other cultural data such as buildings and roads, with a geographic reference such as latitude and longitude or Universal Transverse Mercator (UTM), grid information.

Geologists use topographic maps as base maps for construction of surface geologic maps. Geophysicists typically use shot point maps, which show the orientations of seismic lines and the specific points at which seismic data were acquired, to display interpretations of seismic data.

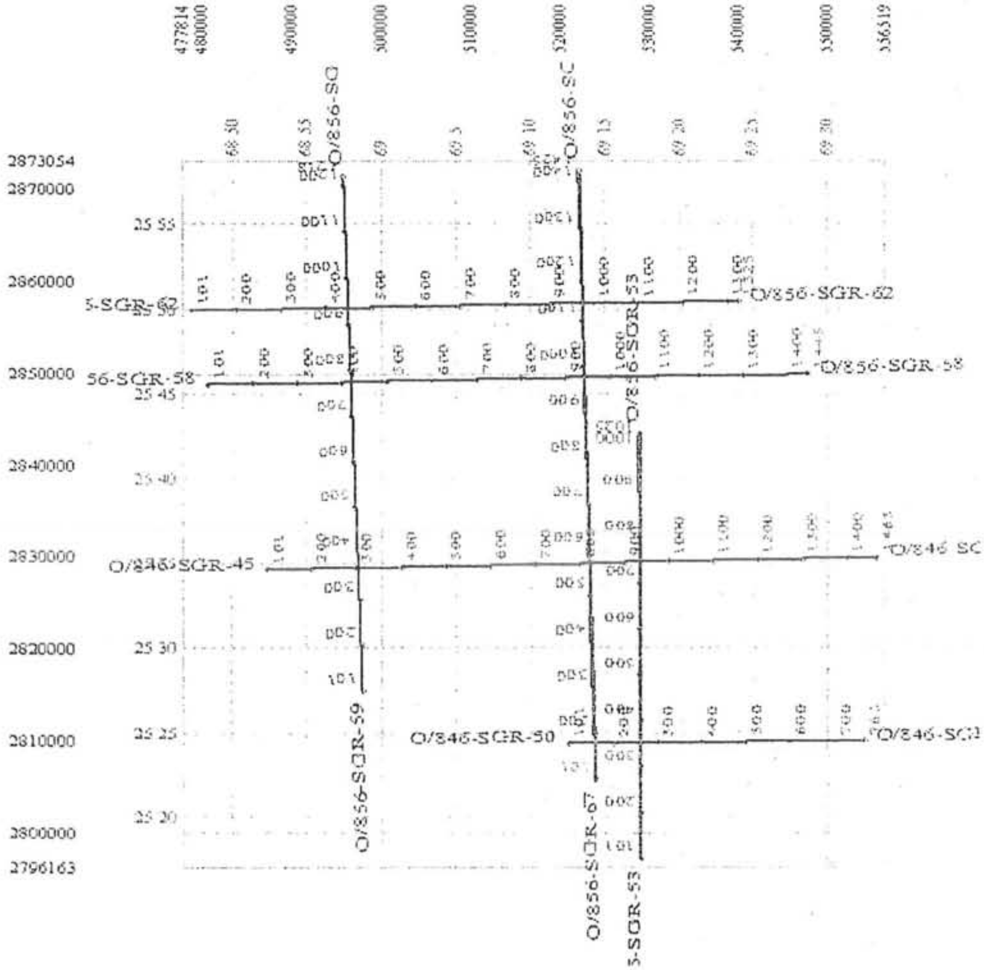


Fig :1.2 Base-Map of the Study Area

1.3 FIELD PARAMETERS

Header contains information about the different parameters involved in acquisition and processing sequence which are given below.

Source information

SOURCE	DYNAMITE
NO. OF HOLES	9

	18
DEPTH	2 M
CHARGE	9*1 KG
	18*0.5 KG
SHOT INTERVAL	50 M
STATION INTERVAL	50 M

Receiver information

GEOPHONE INTERVAL	5 M
GROUP INTERVAL	50 M
SPREAD	2550-200-0-200-2550 M
SAMPLE RATE	2 MSEC
RECORD LENGTH	6 SEC
ALIAS FILTER	125 HZ

Filming parameter

PERCENT GAIN	178
HORIZONTAL SCALE	32.000 TR/IN
VERTICAL SCALE	2.500 IN/SEC
POLARITY	BLACK =POSITIVE

1.4 DATA PROCESSING

After the data has been acquired, it passes through the whole processing sequence that includes different data processing techniques that are used to enhance the quality of the data.

This data has passed through a desirable processing sequence and finally a "Time Section" was prepared. The processing sequence is given below

PROCESSING SEQUENCE

DEMUX	DEMULTIPLEX TO PETTY-RAY MPX-1 FORMAT.
SCALE	GAIN RECOVERY CURVE APPLIED.
BALANS	SCALING FACTOR APPLIED TO DATA TRACES.
SORT	GATHER TRACES INTO COMMON DEPTH POINT ORDER AND APPLY FIELD STATICS.
FILTER	BANDPASS FILTER 4/8-50/60 HZ
DECON	TIME DOMAIN PREDICTIVE DECONVOLUTION APPLIED USING OPERATOR LENGTH= 256 MSEC. LAGX=60MSEC. 0.5%WHITE NOISE ADDED PRIOR TO OPER. CALCULATION
FILTER	BANDPASS FILTER 4/8-50/60 HZ
VELSTK	CONSTANT VELOCITY STACK FOR ANALYSIS

NMO	NORMAL MOVEOUT CORRECTIONS AS OBTAINED FROM ANALYSIS
MUTE	TRACE SUPPRESSION AS OBTAINED FROM CDS.
STACK	4800% CDP STACK

1.5 METHODOLOGY AND OBJECTIVES

For study project area, iso velocity and average velocity graphs will be prepared using velocity functions given on the seismic section. Then horizons of intrest will be marked based on their continuity and other interpretation techniques. Based on these marked horizons and above mentioned velocity functions, seismic time section will be prepared. Then a section in depth mode (depth section) will be prepared using the concerned velocities and other informations. Then using the tops of identified horizons on time and depth sections as basis, time and depth contour maps will be prepared for the horizons of interes .

This subsurface information will be used to create a tentative model to understand the trapping mechanisms of the study area.

Using DT and RHOB Log, I will determine the Seismic Parameters (P-Wave, S-Wave, Poisson's Ratio,Bulk Modulus,Shear Modulus, Vp/Vs Ratio and P-Wave and S-Wave Impedence) of lower Goru and by plotting Cross Plots , their application in hydrocarbon exploration.

Petrophysical Interpretation using NHPI and GR Log.

2.1 INTRODUCTION

The information about geology of an area plays very important role for a precise interpretation of seismic data. This chapter deals with a brief description of the tectonic setting, structural geology and stratigraphy of the study area (Sanghar) and adjoining areas, Lower Indus Basin. Petroleum significance of the area is also incorporated. The interpretation of seismic data in geological terms is the objective and end product of a seismic work. To investigate the geology of an area generally two types of information's are necessary:

- The Structural Information.
- The Stratigraphic Information

The structural information involves the knowledge about the geological structures (i.e. faults, folds etc) present in that area and The Stratigraphic Information tells us about different geological formations present there and the unconformities those lie between them.

Seismic data interpretation is based on the stratigraphy and structure geology of the area therefore it is important to have information about the geologic aspects of the area. The observations made in the present study have also been incorporated in the chapter.

2.2 REGIONAL GEOLOGICAL SETTING

The Indian Ocean and the Himalayas, two of the most pronounced global features surrounded the Indo-Pakistan subcontinent have a common origin. Both are the product of the geodynamic processes of sea-floor spreading, continental drift and collision tectonics. A plate of the earth's crust carrying the Indo-Pakistan landmass rifted away from the super continent Gondwanaland followed by the extensive sea-floor spreading and the opening up of the Indian Ocean. Propelled by the geodynamic forces the Indian plate traveled 5000 Km northward and eventually collided with Eurasia. The subduction of the northern margin of the Indian plate finally closed the Neotythes and the Indian Ocean assumed its present widespread expanse This collision formed the Himalayas and the adjacent mountain ranges.

Pakistan has been divided into two broad geological zones, which are the;

- Gondwanaland Domain
- Tethyan Domain

Pakistan is unique in as much as it is located at the junction of these two diverse domains. The southern part of Pakistan belongs to Gondwanian Domain and is sustained by the Indo-Pakistan Crustal Plate. The northern most and western region of Pakistan fall in Tethyan Domain and present a complicated geology.

2.3 NORTHWARD DRIFT OF INDIAN PLATE AND ITS COLLISION WITH EURASIAN PLATE

The Indo-Pakistan subcontinent separated from the Gondwana motherland about 130 million years ago Johnson, et al.,(1982).

It has been estimated that between 130 my. and 80 my. India moved northward at a rate of 3 to 5 cm/year Jhonson,et al. (1976). From 80 my. ago India moved at an average rate of about 16 cm/year relative to Australia and Antarctica . According to Patriat and Achache (1984), before anomaly 22 (50 my.) this rate of movement varied between 15 and 25 cm/year.

The Neotethys had begun to shrink by the time Indian began its northward drift around 130 my. ago. Intra-oceanic sebduction generated a series of volcanic arcs (Kohistan-Ladakh, Nuristan, Kandhar) during the Cretaceous. This arc was intruded by 102 Ma precollision granitoids Treloar, et al.(1993) followed by the intra-arc rifting and magmatisim. Arc magmatism covered a life-span of about 40 Ma after which the back-arc basin closed and Kohistan-Ladakh arc collided with Eurasia along the southern margin of the Karakoram plate.

The abrupt slowing down of Indian's northward movement between 55 and 50 my. ago is attributed to this collision .The abrupt slowing down of Indian from 18-19.5 cm/year to 4.5 cm/year occurred at 55+Ma. A combined India-Australia plate started moving away from Antarctica. Motion ceased along the former plate boundary (the Ninety East Ridge), and the Proto-Owen fracture no longer remained at transform fault, though it was reactivated later, about 20 Ma ago.

Since 55 Ma ago Indian plate has steadily rotated counterclockwise. Coupled with Arabian's separation from Africa about 20 Ma ago, this rotation caused convergence in Balochistan, closure of some the some smaller basins (Scistan, Katawaz), collision various crustal blocks in Iran-Afghanistan region and formation of the Balochistan fold-and-thurst belt. The India Eurasia collision produced the spectacular along uplifted and deformed 2,500 Km long Indo-Pakistan plate margin(Kazmi and Jan, 1997).

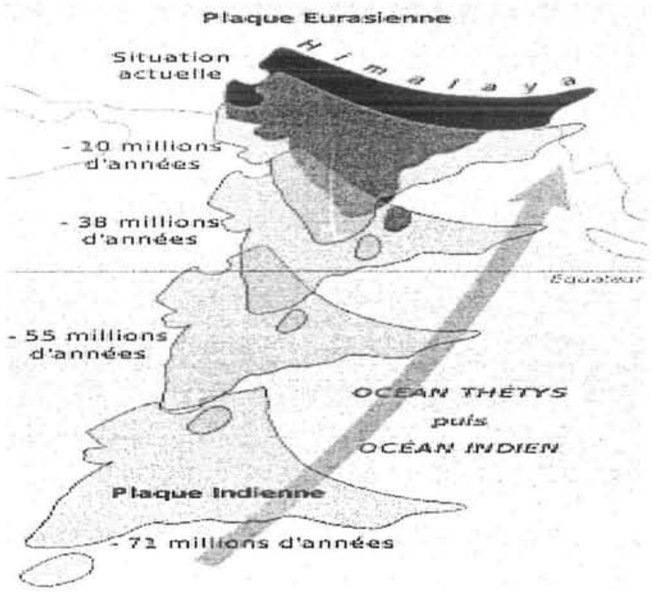


Fig.2.1: Regional tectonic map showing Northward Drift of indian Plate (www.googlemaps.com)

2.4 TECTONOSTRATIGRAPHIC ZONES OF PAKISTAN

Tectonically speaking Pakistan consists of two broad geological divisions, the Gondwanaian Domain and Tethyan Domain (Kazmi and Jan 1997). Pakistan is divided into the following broad tectonic zones Indus platform and fore-deep

- East Balochistan fold-and-thrust belt
- Sulaiman–Kirthar Fold Belt
- Bela–Zhob Ophiolitic thrust belt
- NW Himalayan fold-and-thrust belt
- Indus Suture Zone (MMT)
- Kohistan–Laddakh magmatic arc
- Main Karakoram Thrust (MKT) / Shyok suture zone
- Karakoram block
- Kakarkhorasan flysch / molasses basin
- Makran Accretionary zone and Kharan basin
- Chagai–Ras Koh magmatic arc
- Pakistan offshore
-

Basin is an area characterized by regional subsidence and in which sediments are preserved for the longer periods of time. In a basin a receptacle or container, which is basin's substratum is called the Basement. The container fill or content, which is the accumulation of sediments resting on the basement, is called a called the Basement. The container fill or content, which is the accumulation of sediments resting on the basement, is called a Sedimentary cover. The gradual settling of the basin is called Subsidence. The point of maximum sedimentary accumulation is called the Depocenter. The depocenter may not correspond to the zone of maximum subsidence.

Pakistan comprises the following three sedimentary basins (Ahmed ,1998):

- Indus Basin
- Balochistan Basin
- Pishin Basin/ Kakar Khorasan Basin (kadri, 1995).

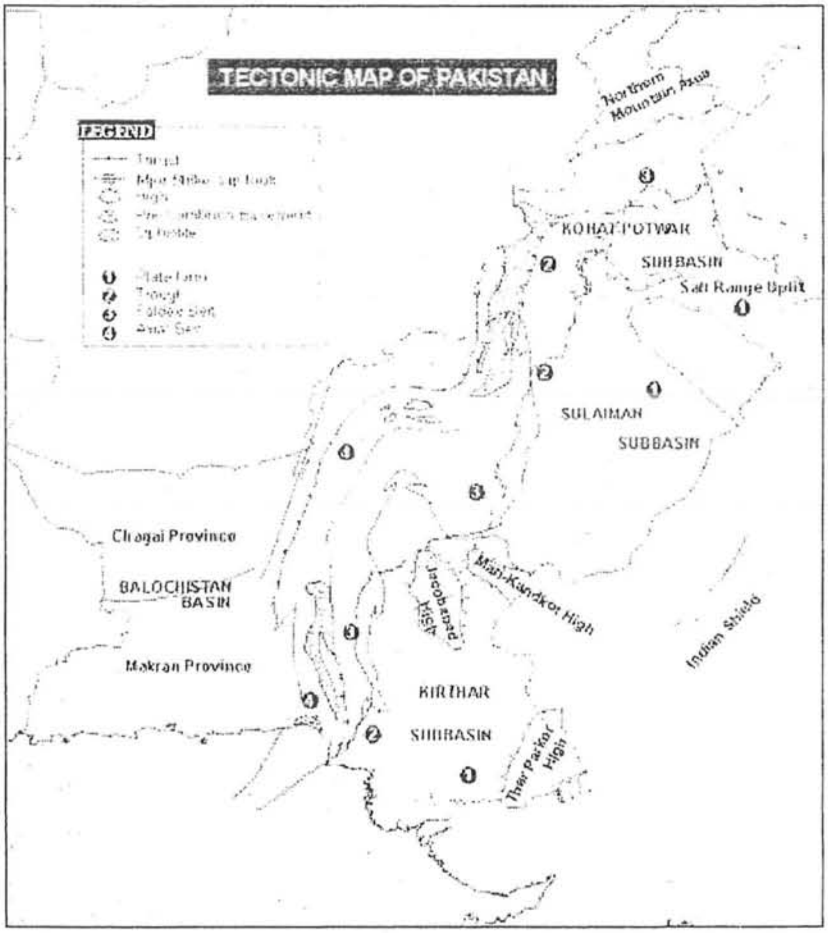


Fig.2.2: Tectonic map showing the main tectonic zones of Pakistan (Kazmi & Jan, 1997)

2.5 GEOLOGICAL EVOLUTION OF THE SOUTHERN INDUS BASIN

Better understanding of geological evolution of the basin may provide strategies for new oil and gas discoveries in Pakistan. A geological history of the basin can be compiled by considering the basin forming tectonics and depositional sequence. The western margin of Indo-Pak continental plate is characterized by past extensional tectonics resulting in rifted protocontinent and new oceanic crust during sea floor spreading. The new oceanic crust was formed at a rate matching the continental separation similar to divergent associated with fossil rift in Africa, Europe and north Atlantic .

Zaigham and Malik proposed a structural model for the evolution of southern Indus basin.

1. This corresponds to the initial rifting of the super continent Gondwanaland, probably during the Paleozoic.The divergent phenomena includes the formation of Basaltic magma in the upper part of the Asthenoshpere, causing broad tectonic up warp and thinning of the overlying Lithosphere, probably resulting from plastic flow in the lower part and extensional faulting in the upper part. The thinning of Lithosphere continued and resulted in the collapse of the tectonic up warp over the magma blister and subsequently the process of sea floor spreading began with basaltic magma upwelling to the earth surface at oceanic Lithosphere.

2. Extensional forces broke the upper brittle crust into blocks separated by active faults during sea floor spreading. It appears that stretching of initial rifted part stopped at some geological time during very late Paleozoic to very early Mesozoic .The stretched crust remained as Indus basin failed rift in sediments started to accumulate.

3. The third step represents subsidence of the stretched continental crust and simultaneous accumulation of the Mesozoic and Tertiary sediments in the Indus basin.

Thick Cenozoic strata are exposed along the western margin of the Indus basin in the Kirther Fold and Thrust Belt. A few small isolated outcrops of Tertiary are exposed near Khairpur in the northern part and Hyderabad in the southern part.

Tertiary strata have also been reported from Jaisalmir and Ran Ketch areas. Unconsolidated quaternary sediments rang between 30m and 200m thick in the southern Indus basin.

2.6 BASIN CLASSIFICATION OF THE SOUTHERN INDUS BASIN

This basin is located just south of Sukkur Rift, a divide between Central and Southern Indus basins. It comprises the following main units (Kadri, 1995).

- Thar Platform
- Karchi Trough
- Kirthar Foredeep
- Kirthar Fold Belt
- Offshore Indus

The platform and trough extend into the offshore Indus.

The Southern Indus Basin is bounded by the Indian Shield to the east and the marginal zone of Indian Plate to the west. Its southward extension is confined by offshore Murray Ridge- Oven fracture plate boundary. The oldest rocks encountered in the area are of Triassic age. Central and southern Indus basins were undivided until Khairpur - Jacobabad High became a prominent positive feature. This is indicated by homogeneous lithologies of Chilton Limestone (Jurassic) and Sember Formation (Lower Cretaceous) across the High. Sand facies of Goru Formation (Lower Middle Cretaceous) are also extending up to Kandhkot and Giandari area. This is further substantiated by Khairpur and Jhatpat wells located on the High. In Khairpur-2 well, significant amount of Lower Cretaceous and Paleocene is missing while in Jhat Pat-4, the whole Cretaceous and Paleocene are absent with Eocene directly overlying Chilton Limestone (Jurassic). Paleocene facies south of the High are quite different from that in north and are dominated by clastic sediments derived from the positive areas (Khairpur- Jacobabad High and Nabisar Arc).

THAR PLATFORM

It is a gently sloping monocline analogous to Punjab Platform controlled by basement topography. The sedimentary wedge thins towards the Indian Shield whose surface expressions are present in the form of Nagar Parkar High. It differs form the Punjab Platform in that it depicts the buried structures formed due to extension tectonism resulting from the latest counter clockwise movement of Indian Plate. It is bounded in the east by Indian Shield, merges into Kirthar and Karachi Trough in the west and is bounded in the north by Mari-Bugti Inner Folded Zone. The Platform marks very good development of Early/Middle Cretaceous Sands (Goru), which are the reservoirs for all the oil/gas fields in this region.

KARACHI TROUGH

It is an embayment opening up in to the Arabian Sea. The Trough is characterized by thick Early Cretaceous sediments and also marks the last stages of marine sedimentation. It contains a large number of narrow chain like anticlines, some of which contains gas fields (Sari, Hundi, Kothar). The Early Middle and Late Cretaceous rocks are well preserved in the area. It has been a trough throughout the geological history. The Upper Cretaceous is marked by westward progradation of a marine delta.

The most interesting feature of Karachi Trough is the reportedly continued deposition across the Cretaceous/Tertiary (K/T) boundary wherein Korara Shales were deposited, the basal part of which represents Danian sediments. This localize phenomenon probably represents a unique example where no hiatus in sedimentation occurred at the end of Cretaceous era. Else where in Pakistan, a break in deposition marked by laterites, bauxites, coal etc. is a common feature across the K/T boundary.

KIRTHAR FOREDEEP

Kirthar Foredeep trends north south, which has received the sediments aggregating a thickness of over 15,000 meters. It has a faulted eastern boundary with Thar Platform. It is inferred that the sedimentation has been continuous in this depression. However from the correlation of Mari, Khairpur and Mazarani wells it appears that the Upper Cretaceous would be missing in the area. Paleocene seems to be very well developed in the depression but is missing from Khairpur – Jacobabad High area. This depression, like Suleiman Depression, is the area of great potential for the maturation of source rocks.

KIRTHAR FOLD BELT

This north-south trending tectonic feature is similar to Suleiman fold belt in structural style and stratigraphic equivalence. Rocks from Triassic to Recent were deposited in this region. The configuration of the Kirthar fold belt also marks the closing of Oligocene- Miocene seas.

The western part of the Kirthar fold belt adjoining the Balochistan basin, which marks the western edge of the Indus Basin, is severely disturbed. This western margin is associated with hydrothermal activities, which resulted in the formation of economic mineral deposits of Baryte, Fluorite, Lead, Zinc and Manganese.

OFFSHORE INDUS

This area forms the part of passive continental margin and appears to have gone through two distinct phases of geological history

(Cretaceous-Eocene and Oligocene- Recent). Sedimentation in offshore Indus region started from Cretaceous time. However deltaic and submarine fan sedimentation has occurred since middle Oligocene time with the inception of Proto-Indus System.

Offshore Indus is divided into Platform and depression along a Hinge Line in close proximity and parallel to 67^0 E Longitudes. Offshore Platform is divided into Karachi Trough and the Thar Platforms deltaic area by a line, which divides Karachi Trough from Thar Slope onshore (Kadri, 1995).

2.7 TECTONIC OF SINDH MONOCLINE

Tectonics of Indian platform of which Sindh monocline forms a part has been discussed by many authors. The northward movement of Indian platform generated compression where accompanying anticlockwise rotation produced tension. As a result of tension the platform was split into grabens and horst. This tectonic setting provided the ideal condition for widespread deposition of sediments exhibiting a variety of facies, including organic rich Sembar shale (Source rock) and highly porous and permeable Lower Goru sands. (Reservoir Rock) .

Two sets of faults indicting two different episodes of rifting are developed in the platform. The first set of faults associated with early cretaceous Kutch rift phase and the second set is a consequences of Late cretaceous Cambay rift phase.

A very investigation feature can be observed while looking at the map of these discoveries. The gas and condensate fields are concentrated in the north eastern and south western parts of monocline. Whereas the oilfields are restricted to the center of the area on the basis of the concentration of the gas, oil and condensate fields, the authors infer that late cretaceous Cambay rift divided Sindh monocline into Mithrao Tando Ghulam Ali Graben, Pakistan Bari Horst and Daru Nur Grabens.

2.8 HYDROCARBON POTENTIAL OF THE AREA

The study area lies in the extensional regime. Tectonically it is not so much complex but due to extensional regime normal faulting has been occured in the area during the first stages. These normal faulting form horst and grabben and half grabben structures which are very important for hydrocarbon accumulation and are good structural trapes. The area has very rich source and reservoir rock formations.

SOURCE ROCKS

Source rock is the productive rocks for hydrocarbons. They also initiated the conversion of organic compound into oil and gas form. The Formations, which act as source rocks in the project area are as follows.

Sember Formation is believed to be the source of hydrocarbons in Badin platform field and huge gas accumulation in Sulaiman province. Potential reservoir occurs within the sand stone of formation. Ranikot shale was used to be considering as the main source for all the gas present in that region. The Upper Goru sand act as a good source rock in Sindh Monocline.

RESERVOIR ROCKS

The rocks that contain the hydrocarbons have the porosity as well as permeability is as follows Chilton Limestone, Lower Goru Formation, Parh Limestone, (No oil or gas shows have been found in Parh limestone).

CAP ROCKS

The rocks that act as a cap rock and used to seal the hydrocarbons are called Seal rocks. These should be impermeable. The following formations act as seal rock in the Study area are Ranikot formation, Goru Formation and Sember formation.

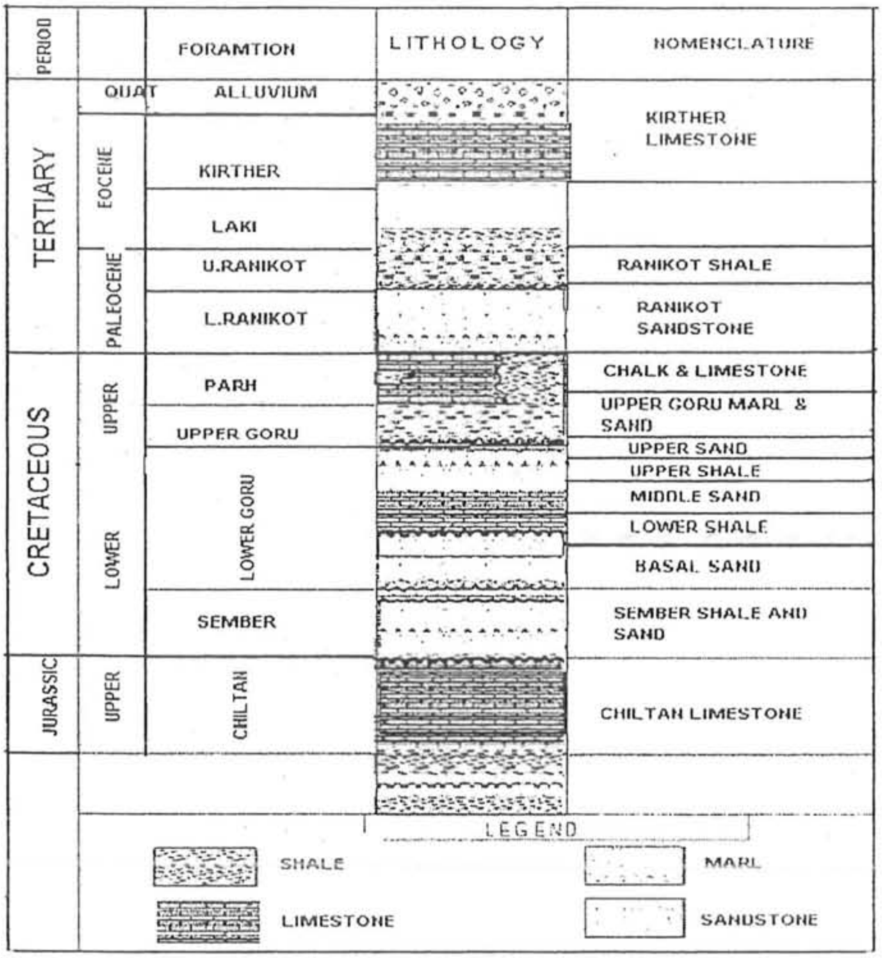


Fig.2.3: Stratigraphic Column of Southern Indus Basin showing the stratigraphic units from Jurassic to Tertiary.

2.9 FUTURE PROSPECTS

Aero magnetic data indicate a deep seated NS trending fossil failed rift in the Southern Indus Basin on the western margin of the Indo-Pakistan continental plate. Horst and Graben structures have been identified in the subsurface associated with Indus fossil rift. The deep and extensive sedimentary basin, known as the Southern Indus Basin, appears to have a developed owing to creation of the failed rift and subsequent subsidence and sedimentation processes. The distribution of the seismic epicenters in the Indus plane exhibit a close association with the regional EW trending system of transcurrent faults related to the Indus Basin fossil rift, which seems to be active even at present, causing deformation of the overlying mountain ranges and geomorphologic features. The presence of the fossil failed rift has identified encouraging prospects of new discoveries of oil and gas in the

Southern Indus Basin, because favorable conditions related to the sources, earth heat, reservoirs and seals prevail in the proposed geological models. The present basement interpretation, combined with the presence of known hydrocarbon source beds, reservoirs, and structures found in the surrounding basin should be further interpretated to delineate new exploration target as the vast tracts await drilling in the Southern Indus Basin.

DATA ACQUISITION

3.1 INTRODUCTION

The seismic methods utilize the fact that seismic waves travel with different velocities in different rocks. The principle is to initiate such velocities at a point and determine at a number of other point, the travel time of energy that is refracted or reflected by the boundaries between different rocks formations, when enable the position of the boundaries to deduced.

There of two types of methods in seismic prospecting

- Seismic Refraction method.
- Seismic Reflection method.

3.1.1 SEISMIC REFRACTION METHOD

Refraction method base on the study of elastic waves refracted along geological layer. This method is generally used for determining low velocity zone (Weathering layer). This method is used as supplement with refraction method.

3.1.2 SEISMIC REFLECTION METHOD

This method is based on the study of elastic waves, which are reflected from subsurface interface between two geological layers. These layer differ from each other in densities, velocities and product of density and velocity is called Acoustic impedance. When a seismic wave strikes the interface of two layers having acoustic impedance contrast, it is reflected back. The seismic reflection is very powerful tool being widely used in oil and gas exploration.

Depth of reflecting interfaces can be estimating from the recorded time and velocity information that can be obtain either from reflected signal themselves or from surveys in well.(Dobrin & Savit, 1988).

3.2 SEISMIC DATA ACQUISITION

The basic field activity in seismic surveying is the collections of seismogram which may be define as analog or digital time series that register the amplitude of ground motion as a function of time during the passage of seismic wave train.

The acquisition of seismogram involves conversation of the seismic ground motions into electrical signals, amplification and filtering of the signal and their registration on a chart recorder and / or take recorder. Kearey,et al.(1996)

According to (Robinson and Coruh,1988) the component which are involve in collection of seismograms, are:

- Input source

- Profile array
- Recording instruments

3.2.1 INPUT SOURCE

Input devices are used to produce vibrations in the ground; different kinds of input sources include impulsive as well as non impulsive sources.

IMPULSIVE ENERGY SOURCES

Sources include dynamite, ammonium nitrate, which are available in different sizes. For most seismic surveying the explosive charge is detonated in a hole. The depth of this shot hole can range from few feet to hundreds depending on various circumstances. Explosives can be used for marine surveying but other more convenient devices are satisfactory for many purposes, one such device capable of producing strong impulses of energy is called as Air gun.

NON IMPULSIVE SOURCES

Explosives are very effective for producing seismic waves, but the potential for destructive side effects and the time, cost and inconvenience of drilling shot holes provides incentive for developing alternate energy sources. Much seismic surveying must be done along public roads ways where permits for drilling and detonating explosives can be difficult or impossible to obtain. The best alternative is the vibroseis system.

In the vibroseis system a pad pressed firmly to the ground produces energy, which vibrates in a carefully controlled way. The pad, which is about one square meter, is attached beneath a truck by a hydraulic jack. Extending these jacks allows the weight of the truck to be used to press the pad to the ground. The vibration produce of varying frequencies called sweep signals. The vibrations that vary from low frequency to higher and from higher frequency to lower are called upsweep and down sweep respectively. The typical sweep signal last for seven or more seconds and varies in frequencies between limits of about 10 and 80 Hz.

3.2.2 SOURCE/RECEIVER ARRAY

The purpose of the shots and geophone arrays in cancellation of some noises e.g. ground roll enhancement of signal.

Real earth structures posses more irregular boundaries and some velocities difference from place to place in a layer. Seismic profiling helps us to resolve these variations more accurately.

Following are some spreads being used in seismic reflection methods.

BASIC SPREADS

In seismic reflection surveys the arrangement of the geophones that are use to record data is called spread. The interpretation of seismograms is simplest if the geophones are arranged in straight lines. The basic straight lines spreads are given below:

END SPREAD

The shot point is located on the side of the spread in which geophones are arranged in straight line.

IN-LINE OFFSET SPREAD

It is modified form of end spread in which shot point is located on one side, some distance away from the first geophone.

SPLIT SPREAD

Geophones are arranged on either sides of central shot point.

CROSS SPREAD

The geophones are arranged in cross shaped around the central shot point.

L-SPREAD

Geophone is distributed around the shot points as L- shape.

3.2.3 RECORDING INSTRUMENTS

GEOPHONE

The receiver used to detect ground vibrations is called a geophone or a seismometer. It is used for seismic surveying on land and it can be operated on ocean floor if mounted in a suitable container. Most common type of geophone is moving coil geophone. It consists of a cylindrical coil that is suspended from a spring support in the field of permanent magnet that is attached to the instrument casing. The magnet has a cylindrical pole piece inside the coil and an annular pole pieces surrounding the coil.

Due to ground vibrations the coil starts too and fro motion in the magnet field that generates the voltage across the terminal of the coil. The geophone is fixed by a spike base into soft ground or mounted firmly on hard ground. Kearey,et al.(1996)

The geophone signals are transmitted to the recording system by means of seismic cables.

3.3 RECORDING SYSTEM

- Analog recording system
- Digital recording system

3.3.1 ANALOG RECORDING SYSTEM

Analog techniques are old techniques which produce continuous graphs. The graphs are obtained either on papers or magnetic tape that represents the variation in amplitude with respect to time, of seismic waves.

3.3.2 DIGITAL RECORDING SYSTEM

The technique of recording the geophone output at discrete moments is called digital recording because the recording consists of series of digits or numbers. Later these numbers can be plotted and the seismogram prepared by connecting the points.(Robinson & Coruh,1988).

The digital data is recorded on a magnetic tape in the form of binary numbers. Each digit of binary number on the tape is called a byte. If the recording head magnetize this byte then it indicates "1" otherwise it is "0".

Digital recording system has following units:

MULTIPLEXER

It is a high speed electronic switch that first picks the signal of channel-1 for a period of one micro second and charges its capacitor Then it takes the signal of channel -2 , then to channel-3 and so forth up to last channel. Then again it switches channel-1 and repeats the same procedure. Hence the data recorded, will be in multiplex form.

AMPLIFIER

The recording signals are then amplified by passing through the amplifier and then these signals are transmitted to the A/D converter.

A/D CONVERTER

Here the amplified analog signals are converted into digital signals. In A/D converter different combinations of standard voltages are generated and tested to find the particular combination that exactly balances the signals. The voltages making up the combination are transmitted to the formatting unit.

FORMAT

In format generator in the voltage pulses are converted to control signals that activate the recorder head to magnetize the appropriate bits on the magnetic tape. This entire sequence for channel-1 requires less than 30 microseconds.

3.4 SEISMIC NOISE

All type of disturbances created and interference with the signal of interest is called a noise. Noise is divided into two types.

- Coherent Noise.
- Incoherent Noise

3.4.1 COHERENT NOISE

Coherent noise displays some regular patterns on a seismogram. Often it consists of recognizable waves such as surface waves, refracted waves and multiples that are produced by the source.

3.4.2 INCOHERENT NOISE

The coherent noises are caused by natural factors like rain, wind blowing, moving of vehicles etc. Incoherent noise displays no systematic pattern on seismogram.

3.5 INTRODUCTION TO SEISMIC DATA PROCESSING

Data processing is an approach by which the raw data recorded in the field is enhanced to the extent that it can be used for the geological interpretation. (Sadi,1980).

3.6 AIM AND PURPOSE

The basic aim and purpose of data processing is to produce a perfect seismic section by applying a sequence of correction. Actually the seismic reflections from the depth are generally week and need to be strengthened by digital processing of field data. (Robinson & Coruh,1988)

This approach involves the sequence of operation for improving signal to noise ratio.(Dobrin & Sovit, 1988).

The seismic field recorder generally records the data on magnetic tape. These tapes are then transferred to the data processing centre. Where the seismic data is processed. Processing seismic data consists of applying a sequence of computer program.

3.7 PRIMARY STAGES AND PROCESSING OF SEISMIC DATA

According to Yilmas 1987 there are three primary stages in Processing Seismic Data.In usual order of application they are:

- Deconvolution.
- Stacking.

- Migration

3.8 PROCESSING SEQUENCE

The seismic data processing sequence can be broadly defined in five categories. (Yilmaz, 2001)

- Data Reduction
- Geometric Corrections
- Data Analysis and Parameter Optimization
- Data Refinement
- Data Presentation

In Figure 3.1 a systematic diagram is given below explains the stages involved indata processing. (Rehman, 1989).

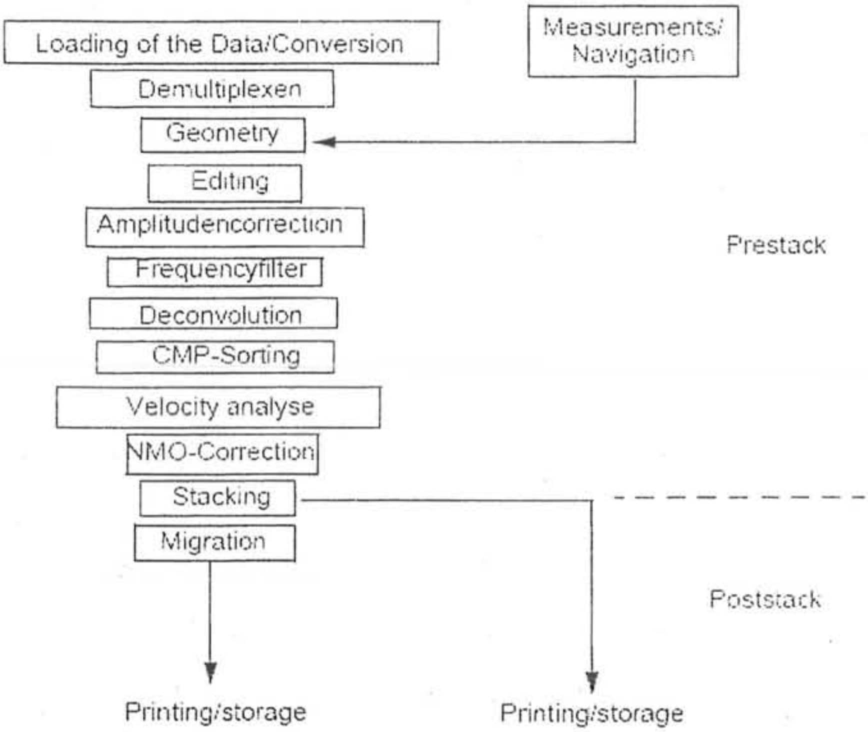


Fig 3.1:Diagrammatic block diagram showing the various stages of seismic processing modified from(Rehman,1989)

3.8.1 DATA REDUCTION

Data reduction is done by certain processing operations as discussed below.

- Demultiplexing
- Geometry definition
- Correlation

- Header generation
- Display
- Editing and muting
- Amplitude adjustment

DEMULTIPLEXING

Data from the field arrive at the processing center in tapes written in multiplexed format, because that is the way the sampling is usually done in the field, successive samples on the tape represents the succession of channels at the same instant of time. Most reflection seismic data are now being recorded on digital magnetic tape unlike analog seismogram which are recorded in form suitable for analysis, digital seismogram must be assembled from the digital tape by a sorting process. This sorting process is called Demultiplexing. Successive sample on the tape represent the succession of channels at some instant in time. Multiplexed data thus used time, not channels at the primary index.

In general the early stages of processing require channel ordered or trace ordered data. Channel Demultiplexing data in this form. First the computer reads the entire digital tape, then it repeatedly Stores a value count pass another "m", value and so until the following sequence have been compiled separately.

$A_{11}, A_{12}, A_{13}, \ldots\ldots, A_{m}$

$A_{21}, A_{22}, A_{23}, \ldots\ldots, A_{2m}$

$\ldots\ldots$

$\ldots\ldots$

$\ldots\ldots$

$A_{n1}, A_{n2}, A_{n3} \ldots\ldots A_{m}$

This unscrambling of multiplexed array into a trace sequent array is called Demultiplexing.

So Demultiplexing is accomplices by a simple compute sorting program and is the first in any Data processing sequence.(Rehman, 1989) .

PROCESS	PURPOSE	WHEN APPLIED
Demultiplexing	Put data into trace sequential order	First

GEOMETRY DEFINITION

The layout of receivers for each shot record the location of all shots along the line, and all such field information must be described in detail to the computer for the geometry-specification step. Most geometry programs can access the digitized base-map file.

Computer access is particularly necessary for processing crooked lines in which sources and receivers are not uniformly distributed along a straight traverse. The geometry program must calculate a source-receiver mid-point based on the two ground locations. All relevant geometric information is retained in the trace headers on the tape so that each trace is uniquely and accurately located. Later programs will time shift or filter as a function of ground location, offset, and/or other spatial coordinate(s) and time.

CORRELATION

Correlation is simply the measurement of similarity or time alignment of two traces. Since correlation is a convolution without reversing the moving array, a similar frequency domain operation also applies to correlation. (Yilmaz, 2001).

There are two types of correlation;

- Cross Correlation
- Auto Correlation

CROSS CORRELATION

Cross correlation measures how much two time series resemble each other. It is not commutative; output depends upon which array is fixed and which array is moved. As a measure of similarity, cross correlation is widely used at various stages of data processing. (Yilmaz, 2001).

AUTO CORRELATION

Correlation of a time series with itself is known as auto correlation. It is a symmetric function. Therefore only one side of the auto correlation needs to be computed. (Yilmaz, 2001)

VIBROSEIS CORRELATION

The signal generated by a vibroseis is not a short pulse but rather a sweep lasting some seven to ten seconds. The sweep is transmitted through earth and reflected signal. Each reflection is a near duplicate of a sweep itself, so the reflections in vibroseis record overlap act are indistinguishable. To make it useable reflections are compressed into wavelets through cross-correlation of data with original input sweep. After correlation each reflection on record looks similar to impulsive source data. This involves cross correlation of a sweep signal (input) with the recorded vibroseis trace. The sweep is a frequency-modulated vibroseis source signal input to the ground (Yilmaz, 2001). There are two types of sweep;

- Up Sweep (When frequency of the vibroseis source signal increases with time)
- Down Sweep (When frequency of the vibroseis source signal decreases with time)

IMPORTANCE OF VIBROSIES CORRELATION

For vibroseis source, we have a sweep (a train of waves) rather than a short pulse/source wavelet whereas most seismic impulsive sources generate a very short pulse which can be used directly to examine subsurface structure Vibroseis sweep lasts for several seconds depending upon the sweep time. So in case of vibroseis source all reflected and refracted signals on a vibroseis seismogram overlap one another extensively. Even after demultiplexing of the vibroseis seismogram it is impossible to recognize the reflections. So vibroseis correlation procedure is applied (Robinson. & Coruh, 1988).

Vibroseis correlation enables us to extract from each of the long overlapping sweep signals on vibroseis seismogram, a short wavelet much like those obtained with seismic impulsive source

HEADER GENERATION

Trace header information may include location and elevation of source and receiver, field record number, trace number etc .A real header block is also placed at the head of each reel, for recording line number, reel number etc.

DISPLAY

At any point of processing sequence the seismic analyst can display the data in wiggle trace or other modes. The choice of display is a matter of the client taste, but is not affected by company dictum. Currently, the data provided by OGDCL is the variable area with wiggles plot.

EDITING AND MUTING

Raw seismic data contains unwanted noise and sometime dead traces due to instrumental reasons. Thus the quality of data recorded is first observed by visual examination of raw field traces. Data may be affected by following reasons

- Polarity reversals in data
- Poor traces as well as poor bits

To remove polarity reversal, trace with reverse polarity is multiplied with it that becomes a trace with the polarity. Therefore editing is a process of removing or correcting traces, which in their original recorded taken, may cause stack deterioration. (Rehman, 1989). After doing this all the contributing traces per each CDP are gathered together. Each trace in one CDP is identified by its shot point and receiver numbers .The CDP-gathers may be displayed as such for direct inspection and checking of edited data

Trace-muting is a special type of data editing. This term is applied for process of zeroing the undesired part of a trace. In order to avoid stacking non-reflection events (such as first arrivals and refraction arrivals) with reflection, the first part of the trace is normally muted before carrying out the stacking process .This is occasionally referred to as first break suppression (Sadi,1980).

AMPLITUDE ADJUSTMENTS

Amplitude adjustment is done to recover the true information present in the data. True information means data is irrespective of effect produced due to wave propagation through the subsurface. It is well known fact that a seismic wave is attenuated as it travels in a non-perfectly elastic medium. Along with this effect, signal is further modified by recording station. So reflection amplitude recorded in the field is the end-result of the interaction of the following main factors

- Spherical divergence
- Inelastic attenuation

AUTOMATIC GAIN CONTROL

A grain recovery function is applied on the data to correct for the amplitude effects of wave front (spherical) divergence. (Yilmaz, 2001). This amounts to applying a geometric spreading function, which depend upon travel time, and an average primary velocity function, which is associated with primary reflections in a particular survey area. Gain is applied to seismic data for spherical spreading correction.

Often AGC (automatic gain control) is applied to raise the level of the weak signals. AGC attempts to make amplitudes similar for all off sets, for all time and for all mid points. (Dobrin & Savit, 1988). A typical method of calculating the median or average amplitude with in sliding windows down the trace , then to calculate the multiples needed to equalize the median value in all the window.

3.8.2 GEOMETRIC CORRECTIONS

In order to compensate for the geometric effects, we have to apply certain corrections on the recorded data .These corrections are called as geometric corrections (Dobrin & Savit, 1988). These corrections are applied on the traces gathered during trace editing and muting .The geometric corrections are

- Static correction
- Dynamic Correction

STATIC CORRECTION

Reflections are recorded at the earth's surface, which may vary in elevation, after they have passed through the weathered layer. The weathered layer may vary may vary in both thickness and velocity.

1. Removing near surface effects is desirable so that:

Changes in reflection time across a stacked record section can be attributed wholly to subsurface effects.

Individual traces in CDP gather are properly aligned to preserve reflected signals when they are stacked.

2. Removing near surface effects requires two corrections
   - Weathering Correction
   - Elevation Correction

WEATHERING CORRECTION

A weathering correction replaces the actual travel time through the weathered layer by a computed travel time. The computed travel time would result if the weathered layer (the low velocity layer) were replaced by and equal thickness of the underlying higher velocity rock. Although the weathered layer does vary in thickness, its approximate thickness is usually known from previous experiences in the prospect area.

ELEVATION CORRECTION

The effects of topography on a trace's reflection times are removed by applying this correction, which, in effect, move both source and receiver vertically to a reselected datum surface. This surface is usually (but not always) a flat datum plane.(Rehman, 1989).

PROCESS	PURPOSE	WHEN APPLIED
Static Correction	Vertical time correction	Correct to at least a floating datum before NMO. May correct to final after stack.

DYNAMIC CORRECTION

One of the steps of processing the data is to rearrange the traces to make CDP gathers. The trace from different records which correspond to the same depth points location, are collected together into a single record. The traces are normally arranged within this gather record in order of increasing offset distance. Then the reflected signals from a single horizontal interface align along a hyperbola. The term normal move out or NMO means the variation in reflection travel time with off set distance from source to receiver. As shown in Fig 3.2

PROCESS	PURPOSE	WHEN APPLIED
Dynamic	Horizontal Time Correction	Before stacking

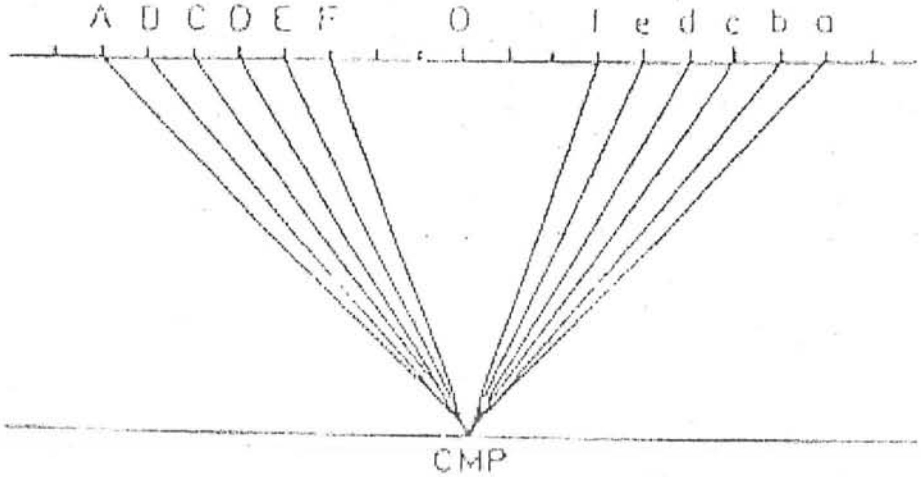


Fig 3.2 Shows Common Mid Point Gathers

3.8.3 DATA REFINEMENT

The processes described till now are used to make data free of the factors that decreases its quality. Also these processes are used to reformat the data and to diagnose its characteristics (Rehman, 1989). Data refinement consists of the following two main stages.

- Stacking
- Migration

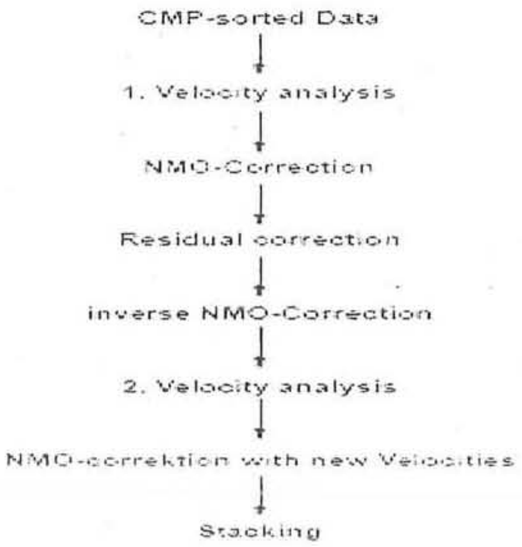
Along with these two processes, there is another procedure occasionally used in data refinement and is called as Residual Statics.

STACKING

Stacking is simply the process of adding up together the traces present in certain gathers, obtained during the seismic data acquisition .It is applied only when the all necessary corrections have been applied. The result of stacking is the corrected gather. In the "corrected gather" the traces have been gathered into the depth order. Both the static and dynamics corrections have been applied to it and the traces have been muted (Dobrin & Savit,1988). All that remains is to stack the data. Stacking result in a single stacked trace as an out put for each depth point present in gathers.

One or other of two considerations is the basis for selecting the seismogram traces that will be stacked. Common offset stacking is done with traces that have the same source-receiver offsets, all of which are centered on the same point (Dobrin & Savit, 1988).

Scheme of residual static corrections



Stacking is a data compression of one to two orders of magnitude. The signal-to-random noise ratio is increased through an N fold stack by N. After stacking, the data are displayed at the surface location of the midpoint between source and receiver. When all adjustments to the data have transformed the offset data into time and phase coincidence with the zero offset traces, the common midpoint CMP and CDP are both widely often interchangeably. With dipping reflectors, the CMP after conventional processing is not the CDP. The correct positioning of reflection point will be by migration (Dobrin & Savit,1988).

MIGRATION

The process of shifting the reflection points to the positions that correctly image the reflector and remove diffraction images, so that we may get an accurate picture of underground layers.If the reflector is flat, the reflection point will be located directly beneath the shot/receiver station, and the record section displays the event in its true position, plotted in time rather than depth (Robinson & Coruh, 1988).

However, if the reflector is not flat, the reflection point will not lie directly beneath the shot/receiver position, and the true position of the reflector will differ from its apparent position. (Yilmaz, 2001). Figure 3.3 shows the subsurface dipping reflector's response.

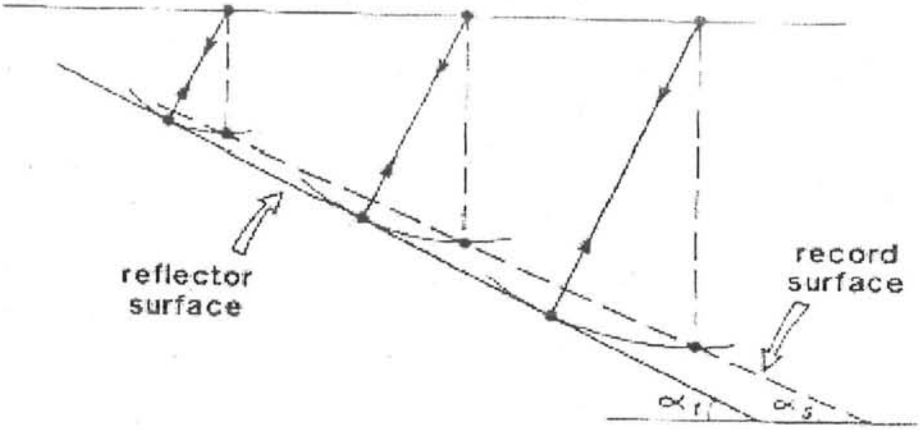


Fig:3.3 Seismic response form a dipping reflector, the recorded surface gives the apparent dip of the reflector surface (Rehman, 1989)

Therefore, migration is a tool used in seismic processing to get an accurate picture of the subsurface layer. It involves geometric repositioning of recorded signals to show a boundary or other structure, where it is being hit by the seismic wave rather than where it is picked up Now, not only the position but the dip angle can incorrectly imaged by vertically plotting. (Rehman, 1989).

IMPORTANT FEATURES OF MIGRATION

Following are the important features of migration (Rehman, 1989);

- Migration steepens the reflectors, as the dip angle of the reflector in the geologic section is greater than in the time section.
- Migration shortens the reflectors, as the length of the reflector on the geologic section is shorter than in the time section; thus, migration moves reflectors in the up dip direction
- When migration is applied in case of the undulating, reflector the crests become narrower and troughs become broad.

TYPES OF MIGRATION

With respect to the stage when migration is applied on the seismic data during processing, there are two important types of migration (Rehman, 1989).

- Pre-Stack Migration
- Post-Stack Migration

4.1. INTRODUCTION

In seismic, interpretation is defined as:

"The translation of seismic information into geologic terms" This process call for the greatest possible coordination between geology and geophysics, if it is carried out successful (Dobrin,1976)

According to (Dobrin and Savit,1988) interpretation is the transformation of the seismic reflection data into a structural picture by the application of correction, migration and time depth conversion.

4.2. MEANING OF INTERPRETATION:

The word interpretation has been given many different meanings to geophysicist who handle seismic reflection records and by geologists who put the information from them to use.

- Planning and programming
- Choice of field parameters
- Selection of processing procedure

After seismic map is constructed, an important part of it its interpretation is integrating the seismic data on it with geologic information from surface and subsurface sources e.g. fault traces or geologic contacts. This involves identifying reflectors and making tie to wells or surface features. All this depends upon the amount of information available.

Under favorable circumstances, interval velocities can be determined from reflection records with enough precision to permit them to serve as a basis for identifying lithology.

Geophysicist deals with the seismic section. In seismic method physical measurements are made at the surface, which are then interpretation in terms of what might be in the subsurface the position and behavior of interfaces, which gives rise to each reflection event is then calculated from arrival times. Resulting information is then combined into cross section, which represent the structure of geological interface responsible for the reflection event.

The seismic reflection interpretation usually consists of calculating the position of, an identifying geologically, concealed interfaces or sharp transition zones form seismic pulses return to the ground surface by reflection. The influence of varying geological condition is eliminated along the profiles to transform the irregular recorded travel times into acceptable subsurface models. This is very important for confident estimation of the depth and geometry of the bedrock or target horizons.

According to (Badely,1985). reflection seismic uses sound waves to investigate the subsurface. The acoustic impedance governs reflections, which is one of the rock properties.

Acoustic impedance = interval velocity *density

Reflections arise at boundaries across which acoustic impedance changes. No reflection occurs impedance does not change even if lithology changes. The greater the difference in the acoustic impedance is, the stronger the reflection. The size of change is defined by reflection coefficient (RC).

The major aim of seismic reflection surveying is to reveal as clearly as possible the structure of the subsurface. The geological meaning of seismic reflection is simply an indication of an acoustic impedance boundary where we want to know that whether this boundary marks a fault or a stratigraphic contact with any other boundary. We want to distinguish the feature that is not marked by the sharp boundaries.

A sequence of sedimentary rocks is grouped into unit called formations. These formations can be described in terms of age, thickness and lithology of the consistent layers.

To distinguish different formation by means of seismic reflection is an important question in interpretation of data, which may be structural, lithology, or stratigraphic.

4.3. APPROACHES TO THE INTERPRETATION OF SEISMIC SECTION

There are two main approaches for the interpretation of seismic section

- Structural analysis
- Stratigraphic analysis

4.3.1 STRUCTURAL ANALYSIS

This type of analysis is very suitable in case of Pakistan, as most of the hydrocarbons are being extracted from the structural traps. It is study of reflector geometry on the basis of reflection time. The main application of the structural analysis of seismic section is in the search for structural traps containing hydrocarbons. Most structural interpretation used two way reflection times rather depth and time structural maps are constructed to display the geometry of selected reflections events. Some seismic sections contain images that can be interpreted without difficulty. Discontinue reflections clearly indicate faults and undulating reflections reveal folded beds.

4.3.2 STRATIGRAPHIC ANALYSIS

This type of analysis is helpful in determining the very huge reservoirs of hydrocarbons. These area very rarely used, as it is work of sequence Stratigraphy which is somewhat complicated as compared to the structural analysis. Stratigraphic analysis involves the subdivision of seismic sections into sequence of reflections that are interpreted as a seismic expression of genetically related sedimentary sequences. The principles behind this seismic sequence analysis are of two types.

Firstly, reflections are taken define chrono stratigraphical units, since the type of rock interface that produce reflections are strata surfaces and unconformities, by contrast the boundary of diacdhronous litho logical units tend to be transitional and not to produce reflections.

Secondly, genetically related sedimentary sequences normally comprise the set of concordant strata that exhibit discordance with underlying and overlying strata. According to Dobrin and Savit, throughout the history of the reflection method, it performance in locating hydrocarbons in stratigraphic traps has been much less favorable than in finding structurally entrapped oil and gas.

Stratigraphic oil traps can result from reefs, pitchouts, or other features associated erosional truncation, fancies, and transition and sand lenses associated with buried channels, lakes, or similar sources.

4.4 SOLVING THE VELOCITY TIME PAIRS

On the seismic section we are given the Vrms. This RMS-Velocity is then converted into interval velocity (Vint). This interval velocity is then converted into average velocity (Vavg). After temporal interpolation of this average velocity at 10 ms, it becomes Vavg. (Interpolated) in the [.VEL] format this is then used for time to depth conversion. This entire job is done using Velocity Analysis Software (VAS).

4.4.1 RMS VELOCITY GRAPH

The Root Mean Square Velocity functions given on a seismic section were processed by K-tron VAS (Velocity Analysis System) to compute interval & average velocity functions using Dix equation (1955).

$$V_{rms}=(\sum Vint^{\wedge 2}(Ti-Ti-1)/Ti)^{\wedge 1/2}$$

The input velocity functions are Root Mean Square (RMS) Velocities, from these RMS velocities, we com[pute using VAS Interval and Average Velocities.

The variation of R.M.S velocity with time can be seen in Fig 4.1 for line 856-SGR-58 and in Fig 4.2 for line 846-SGR-50. This graph shows the lateral and vertical behavior of R.M.S velocity information provided on the seismic section.

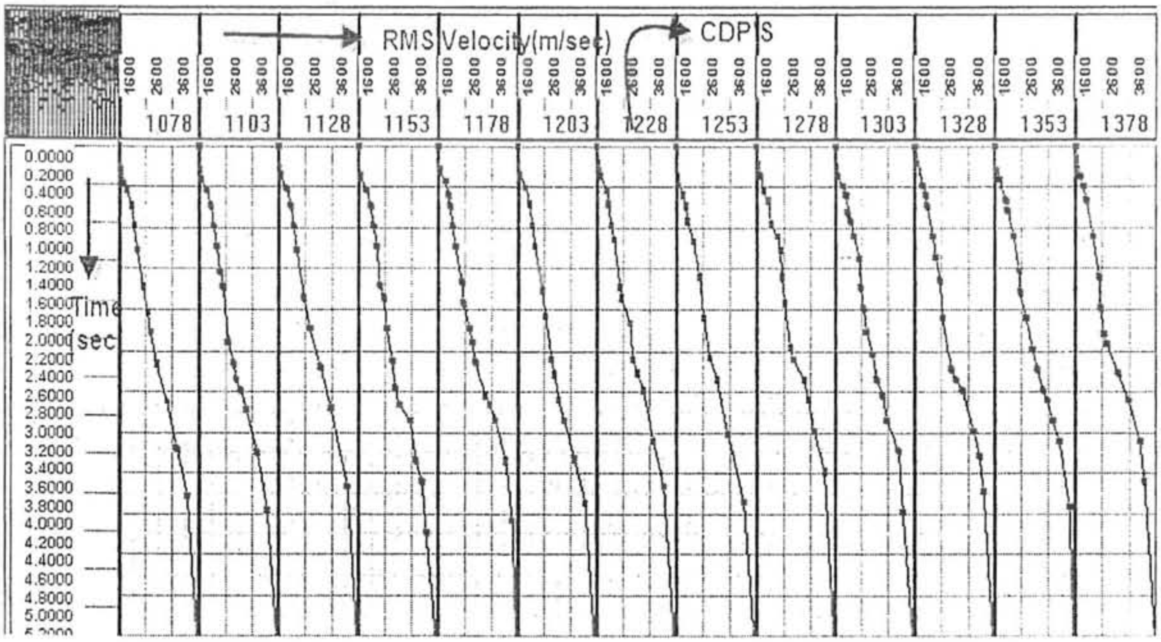


Fig 4.1 RMS Velocity Graph of Line 856-SGR-58

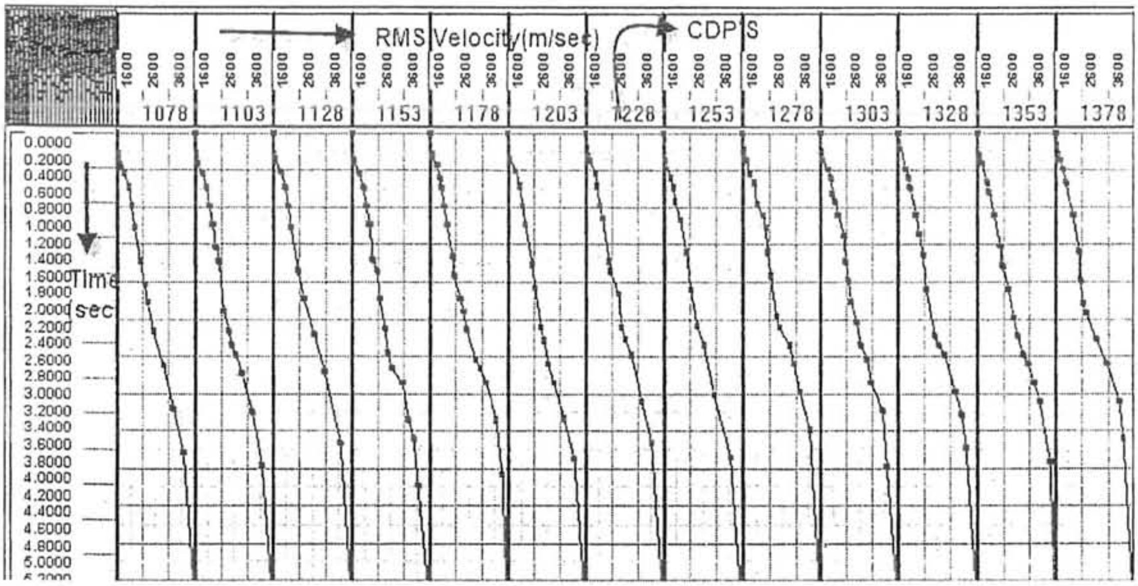


Fig 4.2 RMS Velocity Graph of Line 846-SGR-50

4.4.2AVERAGE VELOCITY AND AVERAGE VELOCITY GRAPH

This is simply the depth 'z' of a reflecting surface below a datum divided by the observed one way reflection one way time 't' from the datum to the surface, so that

$V_{AVE} = z / t$

If 'z' represents the sum of the thicknesses of the layers z_1, z_2, z_3... z_N, then average velocity defined as

$V_{AVE} = (z_1+z_2+z_3+\ldots\ldots+z_n) / (t_1+t_2+t_3+\ldots\ldots+t_n)$

Average velocity can be calculated by using the interval velocities provided on the seismic section using the Dix formula which is

$V_{n,AVE} = (V_{n,INT}(t_n - t_{n-1}) + V_{n-1,AVE}{*}t_{n-1}) / t_n$

From this, average velocities at constant interval of time can also be calculated and then use it for the "Average Velocity Graph". The purpose of preparation of this graph is to observe the vertical variation of average velocity from top to bottom.

The variation of Average velocity with time can be seen in Fig 4.3 for line 856-SGR-58 and in Fig 4.4 for line 846-SGR-50.

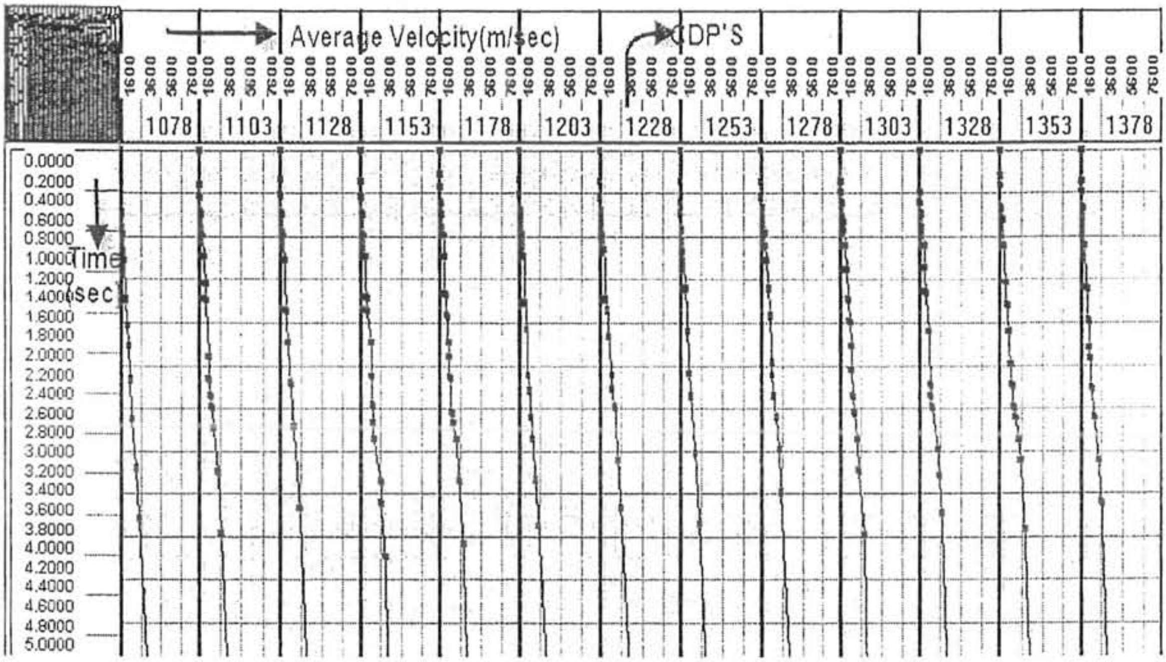


Fig:4.3 Average Velocity Graph of Line 856-SGR-58 This graph shows the lateral and vertical behavior of Average velocity

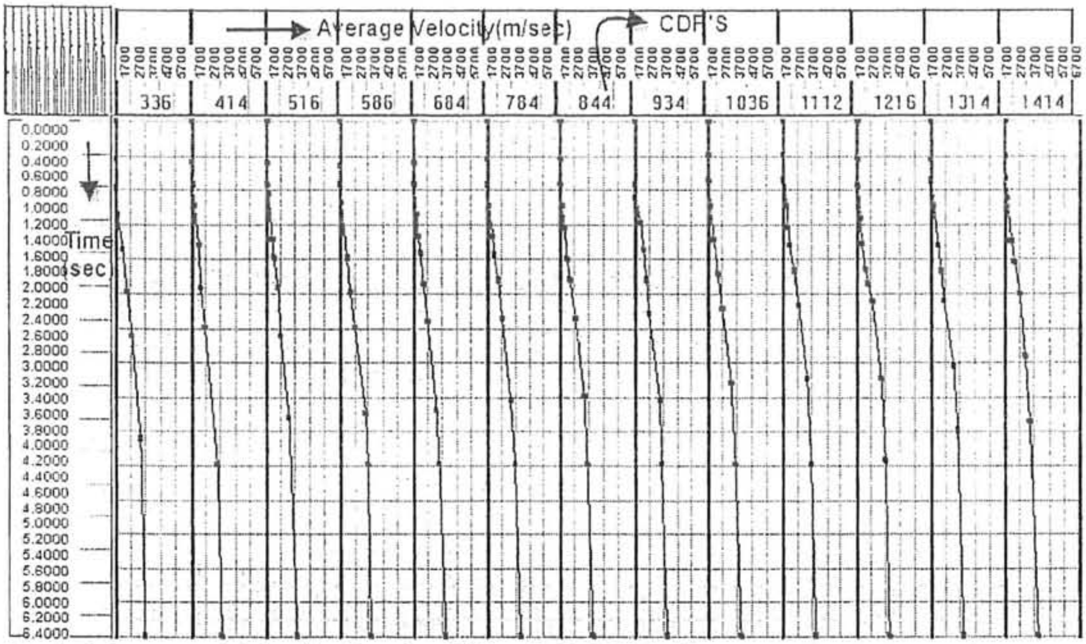


Fig:4.4 Average Velocity Graph of Line 846-SGR-50

4.4.3 INTERVAL VELOCITY

Interval velocity is the average velocity over some interval of travel path of the wave. It can be calculated by Dix equation, that is,

$$V_{n,int} = \frac{V_{n,rms}^{2} * T_n - V_{n-1,rms}^{2} * T_{n-1}}{T_n - T_{n-1}}$$

Where Vint = interval velocity in m/s, Vrms = root mean square velocity in m/s and T is the two way travel time of the seismic wave in millisecond.

Interval velocity is important because it may be used to determine the lithology.. These velocities are also used to determine the reflection coefficient of any particular reflector.. Average Velocity Graph is shown in Fig 4.5 for line 856-SGR-58 and in Fig 4.6 for line 846-SGR-50. For both lines interval velocity is decreasing after certain depth, this decrease may be due presence of hydrocarbon.

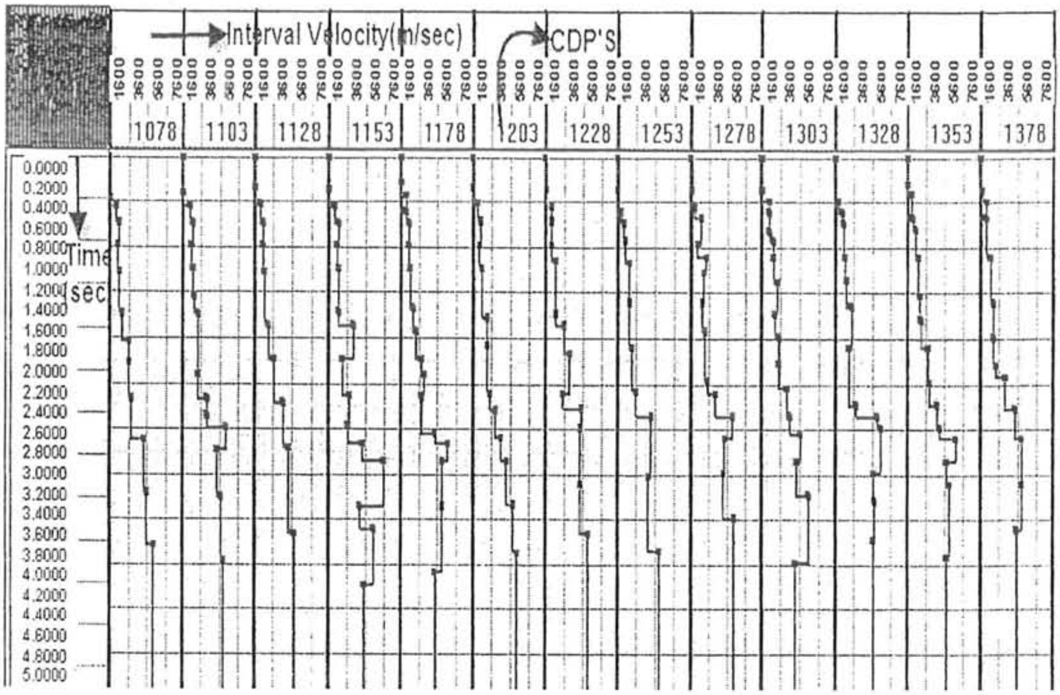


Fig.4.5. Interval Velocity graph of line 856-SGR-58 This Graph deccrese in Interval Velocity at certain depth

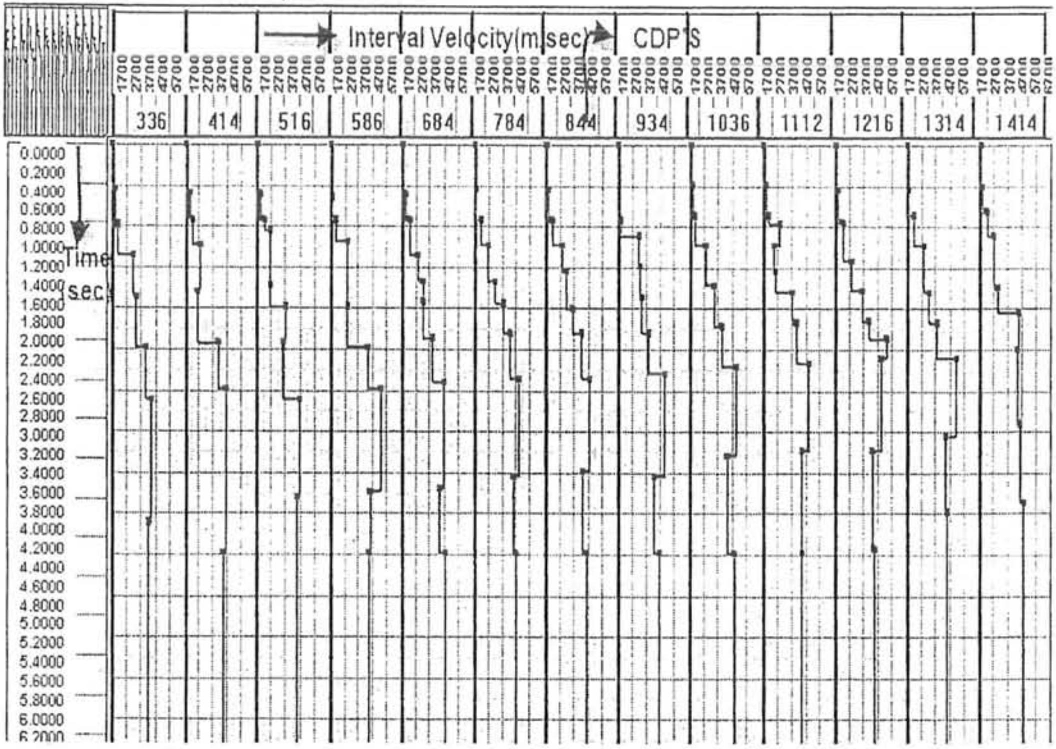


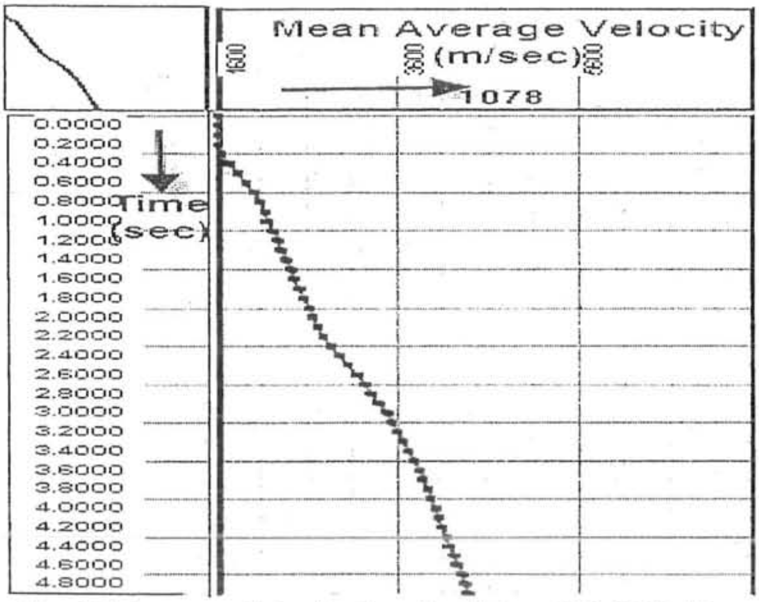
Fig:4.6 Interval Velocity graph of line 846-SGR-50.This Graph shows decrease in Interval Velocity at certain depth.

4.4.4 MEAN AVERAGE VELOCITY AND MEAN AVERAGE VELOCITY GRAPH

This is simply calculated by dividing the sum of average velocities at constant intervals of time with the total number of observations so that

$V_{MEAN} = (V_{AVE\ 1}+V_{AVE\ 2}+V_{AVE\ 3}+\ldots\ldots\ldots+V_{AVE\ n})\ /\ n$

Mean Average Velocity Graph is shown in Fig 4.7 for line 856-SGR-58 and in Fig 4.8 for line 846-SGR-50.



. Fig:4.7 Average Velocity Graph of Line 856-SGR-56

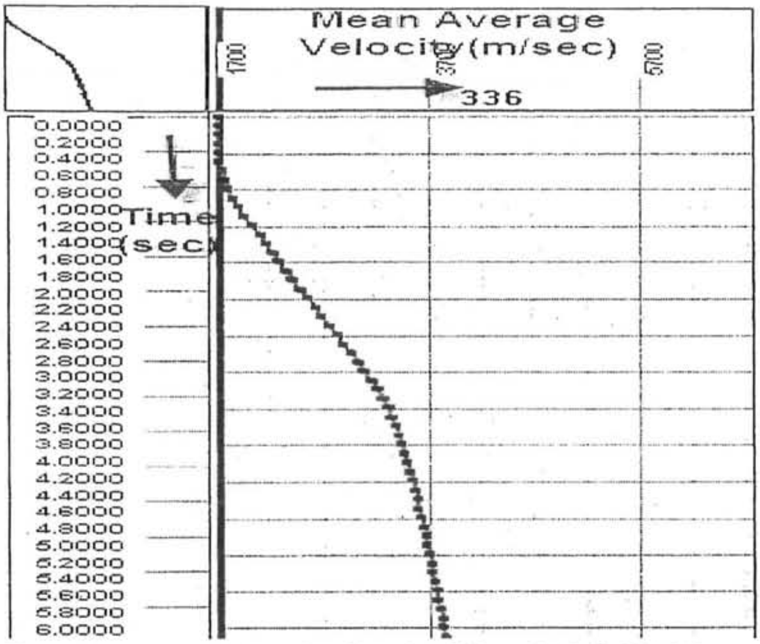


Fig:4.8 Average Velocity Graph of Line 846-SGR-50

4.4.5 ISO VELOCITY CONTOUR MAP

Whenever the CDP's are plotted against times at same average velocities, a section formed which shows the vertical variations of the velocity at different CDP's. The map so formed is termed as the Iso velocity map. It shows same velocity layers. If we consider that each stratigraphic layer has constant velocity through out the whole area and there is no lateral velocity variation, then Iso velocity map will be a very good representation of the seismic section. However this is an ideal situation, which is not the case here.

To generate ISO-Velocity Map K-Tron VAS generated a velocity grid by applying a temporal interpolation at 200msec and spatial 10 CDP'S interval.The final velocity data is transffered to Golden Surfer formate translation programs written in OIL/Visual OIL K-Tron,et al.(2010) to generate iso velocity map. ISO-Velocity Map of line 856-SGR-58 is shown in Fig:4.9 ISO-Velocity Graph shows push up and push down, due to lateral variation in compactness.

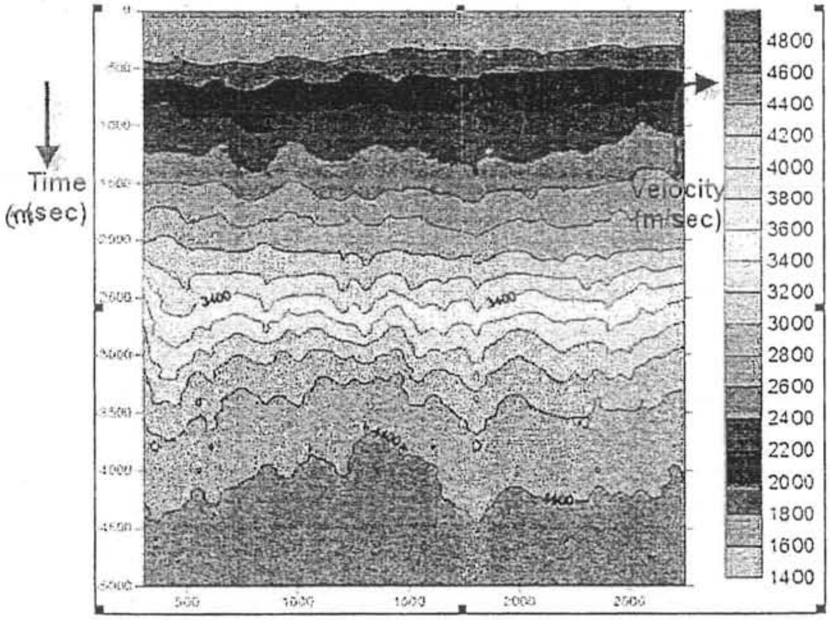


Fig:4.9 ISO-Velocity Map of Line 856-SGR-58.

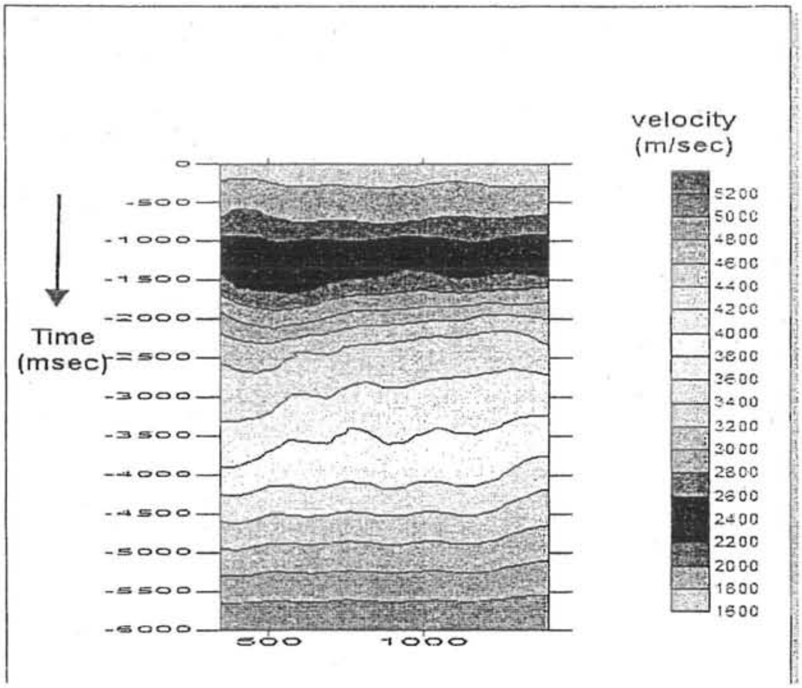


Fig:4.10 ISO-Velocity Map of Line 846-SGR-50

4.5.1 SEISMIC TIME SECTION

A seismic is picture or diagram of a cross section of the earth, composed of data from different seismic shots. In its usual form, it is made up of many wiggly line, or trace, show a modified version of the vibration of the ground at a specific point.

The wiggles on the trace start at a point near the top of the ground and go on down the paper, representing the points farther down into the subsurface. A section is made up of many traces, representing the vibration of the earth at a line of points on the ground.

A wiggle on a trace is an indication of difference between two kinds of underground rocks. The rocks in the sedimentary basin, like southern Indus basin, are usually in the form of layers of wide extent. So wiggle on one trace is usually accompanied by a similar wiggle on the next trace and so on, from the same lager of rock. A continuous line of the side by side wiggles is a seismic horizon. All the other necessary information is also given in the header of the seismic section.

To pick a reflection the most evident indication of the reflection is the dark band of the filled in peaks. To color a reflector, it is easy to decide to pick a peak and then color the trough area of a particular horizon. The color more reflectors it is better to choose the best reflection first, Deccan Trap in case of Sanghar others with the help of this one. Some times a horizon is difficult to pick, an interpretation of this one solely by the use of other reflections is called as Phantom Horizon. The sambar formation of the Sarghar is the Phantom horizon.

For both lines four reflector are marked on Seismic Section. Seismic Time Section shows many Horst and Graben structures which may be favourable for Hydrocorbon accumulation.

The seismic time section for the line 856-SGR-58 is shown in fig 4.11 and for 846-SGR-50 is shown in Fig: 4.12

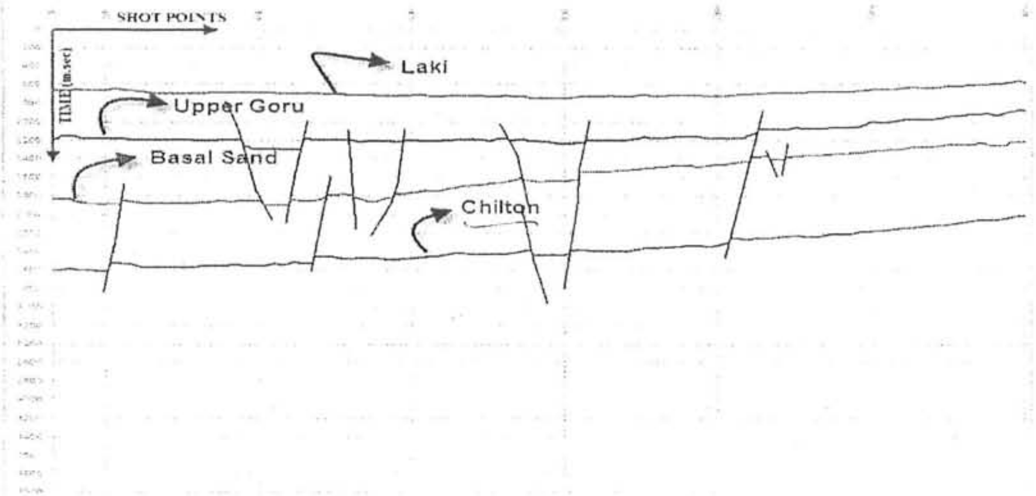


Fig:4.11 SeismicTime Section for line 856-SGR-58

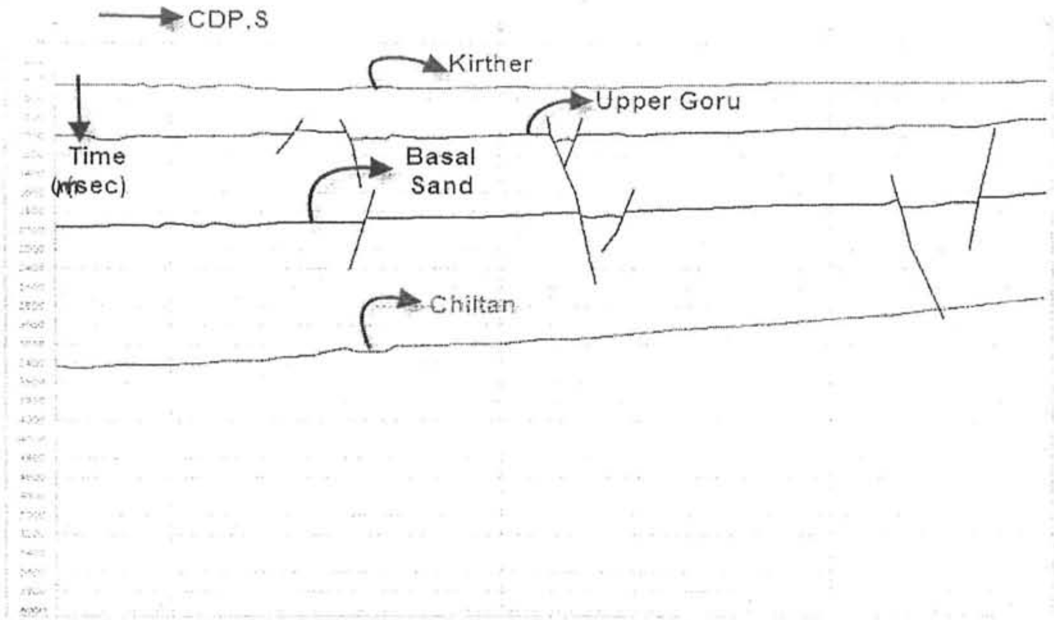


Fig:4.12 Seismic Time Section for line 846-SGR-50

4.5.2 DEPTH SECTION

When we make a map of seismic time it is intended to show the structure of a horizon in the subsurface. Obviously it does not show the structure directly. Structure is matter of depth and the map is travel time of sound waves. To make a map that is more truly related to the subsurface, depths must be calculated from the times. Here we need truly velocities. So with the help of formula given below, we can convert the Seismic Time Section into Seismic Depth Section.

Depth=Average Velocity * Time

But the velocity determined from the seismic data is not accurate and the deeper it is, the poorer it is. So problems will arise when the maps of the depth tie with the wells. This is why most of the maps are made in seismic reflection time. But the velocity pull up and pull down makes the time structure in correct below the feature that is why it is some times essential to make the depth section along with the time maps. Depth Section of line 856-SGR-58 is shown in Fig:4.13 and for 846-SGR-50 is shown in Fig: 4.14. Both Depth Section shows Horst and Graben structures.

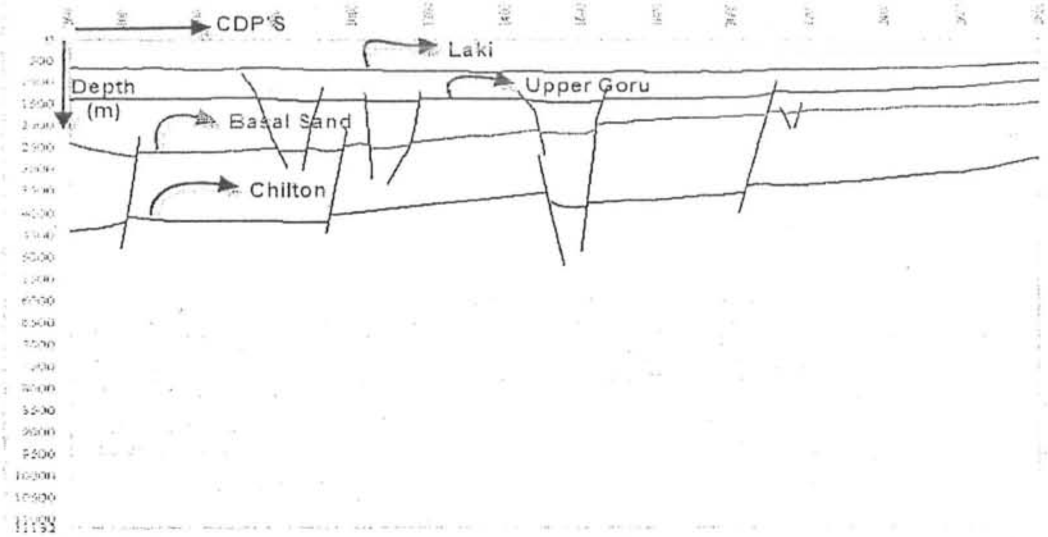


Fig:4.13 Seismic Depth Section for line 856-SGR-58

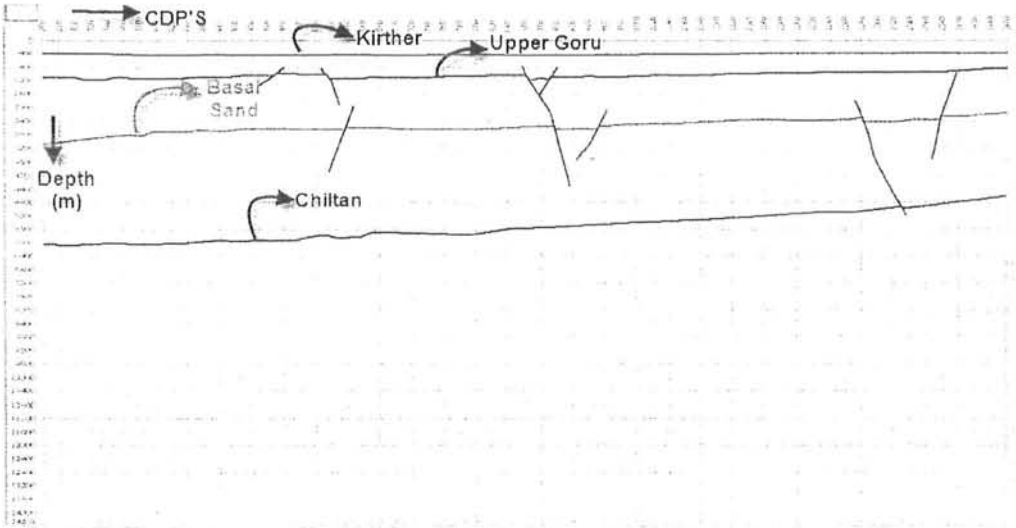


Fig:4.14 Seismic Depth Section for line 846-SGR-50

4.6.1 CONTOUR MAPS

Contouring is the main tool used in industries for delineating the subsurface structures from the interpreted seismic data. On the basis of this contouring wells are proposed. After contouring it becomes obvious that what sort of structure is forming a particular horizon. Basal sand is selected for the purpose of constructing contour maps because they act as good reservoirs in the present study area.

4.6.2 TIME CONTOUR MAP OF BASAL SAND

After the marking of horizons at different levels, the next step is to contour the area at a particular level and prepare its surface. Here the data of six lines are used for contouring which includes 856-SGR-58, 856-SGR-67, 856-SGR-53, 846-SGR-45, 846-SGR-50, 856-SGR-59. One of these three are dip lines and three are strike lines. Using the 'SURFER' the contour maps are prepared. Where contours are closely spaced they show abrupt change in time to the Formations. The time contour map of Basal Sand is shown in the Fig :4.15

Where the contoSur lines in maps are closely spaced, they represent the steeper slope of the structure and where the lines are largely spaced, they represent gentle slope of the structures.

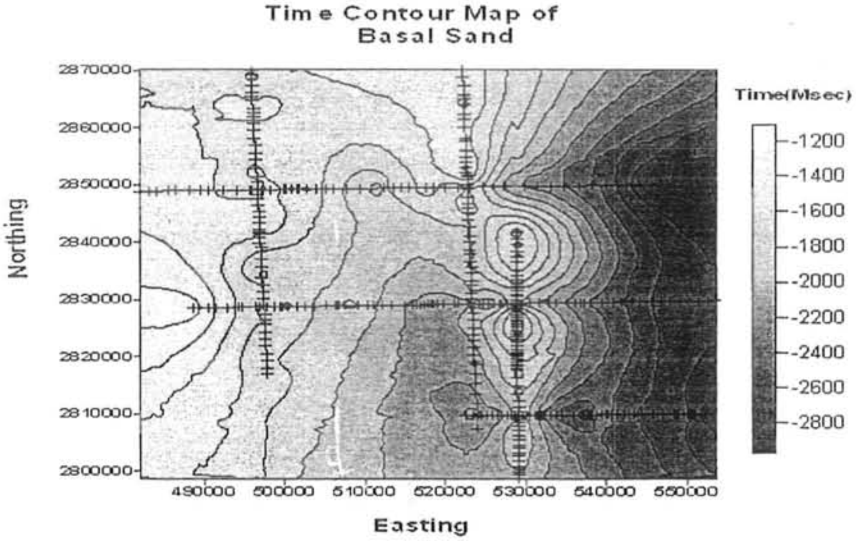


Fig:4.15 Time Contour Map of Basal Sand

4.6.3 DEPTH CONTOUR MAP OF BASAL SAND

By using the same data that is used for the time contour mapping and the velocities additionally velocity functions are used for Depth Contour Map.It shows normal faults.

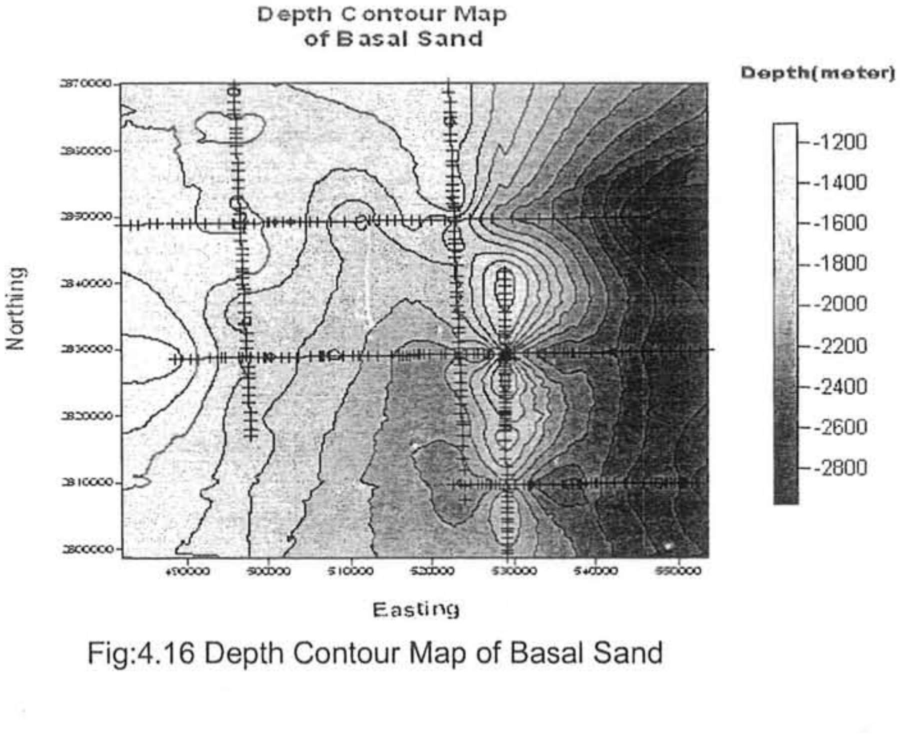


Fig:4.16 Depth Contour Map of Basal Sand

4.7.1 TIME SURFACE MAP OF BASAL SAND

The next step is to make the surface at that level.. The 3D time surface map of Basal Sand is shown in Fig 4.17. It shows many EW trending Horst and Graben Structures.These structures may be suitable for hydrocarbon accumulation.

4.7.2 DEPTH CONTOUR MAP OF BASAL SAND

By using the same data that is used for the time contour mapping and the velocities additionally from the velocity functions. Depth contour map of Basal Sand is shown in the Fig 4.18.It shows many EW trending Horst and Graben Structures.

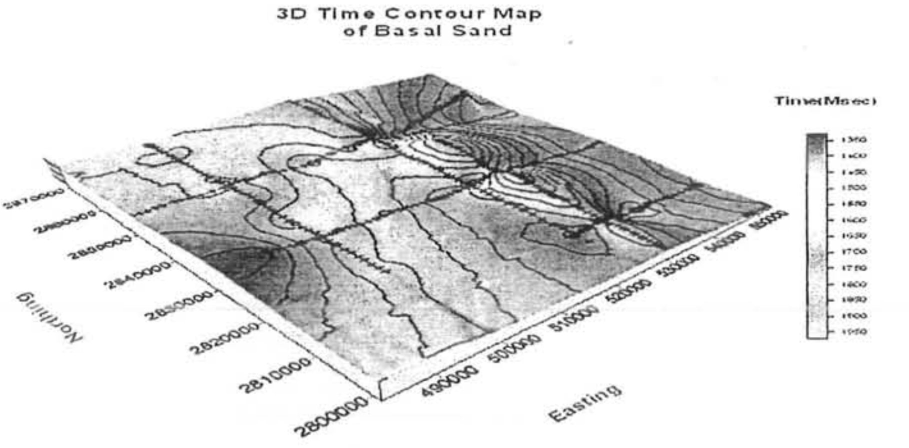


Fig:4.17 3D Time contour Map of Basal Sand

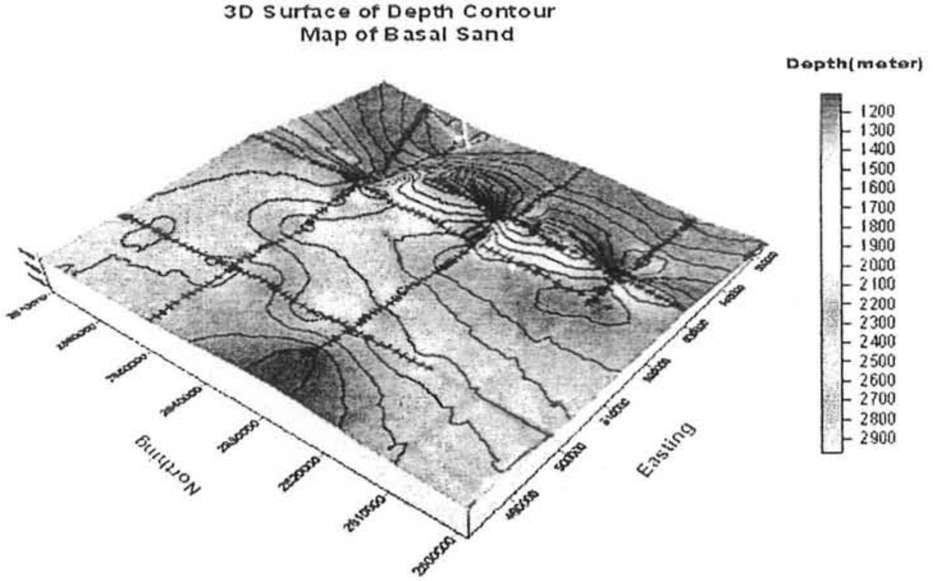


Fig:4.18 3D Depth contour Map of Basal Sand

4.8 ROCK PHYSICS ANALYSIS OF LOWER GORU

Through rock physics analysis we can describe the behavior of a rock unit by analyzing its physical properties such as porosity, rigidity, compressibility & density etc. It also shows that how seismic waves physically behave when they propagate through the earth materials. This analysis has been made for a zone(LOWER GORU) whose depth ranges from 2000m to 2900m. Actually this analysis is made by plotting the cross products of certain physical properties from different logs in order to seek for the existence of some potential zones.

4.9 CALCULATION OF PARAMETERS AND THE ZONE OF INTEREST

The rock parameters which were used in calculation of following graphs are briefly described below:

ρ = Density
K = Bulk Modulus
μ = Shear Modulus
σ = Poisson Ratio
Vp/Vs = Vp/Vs Ratio
All these parameters are shown in Appendix#1

4.9.1 DENSITY DETERMINATION

Density is a major property of rock which describes the amount of solid part of the rock body per unit volume. Direct estimation of density from seismic velocities have been done by using the formula

$$\rho = 0.31 * (Vp)^{0.25}$$

Where ρ = Density, Vp = P-Wave Velocity in m/sec

Density is used in various moduli Calculation.

Density Vs Depth graph is shown in Fig:4.19 this graph show abrubt change in density from depth 2100-2500m. As reservoir is charactrised by low density.

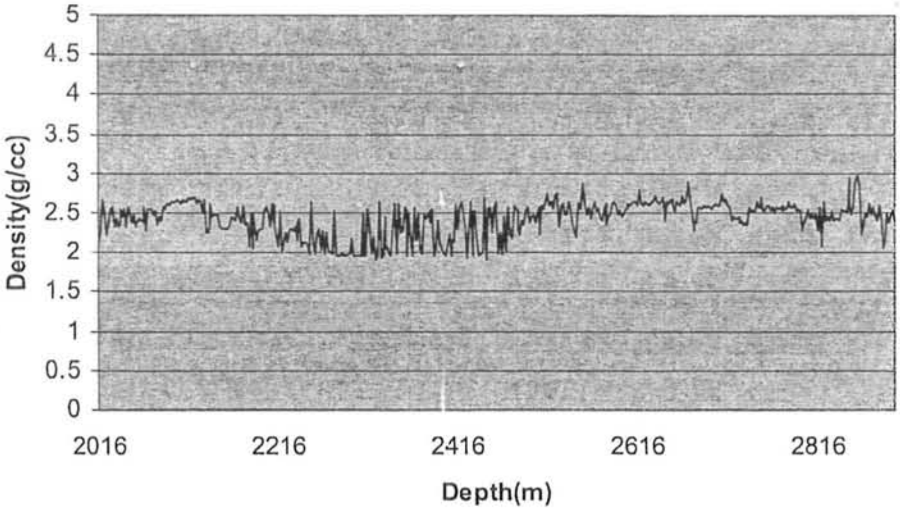


Fig: 4.19 Density Vs Depth

4.9.2 P-WAVE VELOCITY Vs POROSITY OF LOWER GORU

As reservoir is marked by lower P-Wave Velocity with high Porosity Fig.4.20 shows that low velocity are marked by high Porosity, which is favourable for accumulation of hydrocorbon.

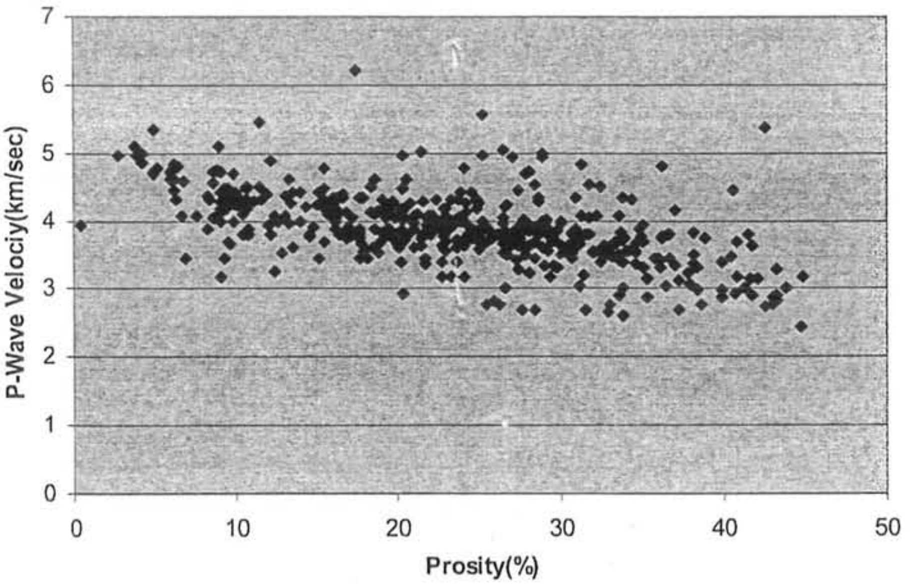


Fig 4.20 Porosity Vs P-Wwave Velocity

4.9.3 THE BULK MODULUS

It is the measure of how much a rock is compressed when seismic waves propagate through it. It is also known as the modulus of compressibility. Certainly different rock types have different values of compressibility due to their porosity, density, mineralogy, grain racking and fluid contents. Estimation of bulk modulus from seismic velocity and density have been done by using formula:

$$K = (Vp^2 - 1.333 * Vs^2) * \rho$$

Where K = Bulk Modulus, ρ = Density, Vp = P-Wave Velocity

Reservoir rock is charecterised by low Bulk Modulus. Fig 4.21 shows that Bulk modulus values are low from the depth 2100-2350m and 2460-2700m, but these have high shale content.

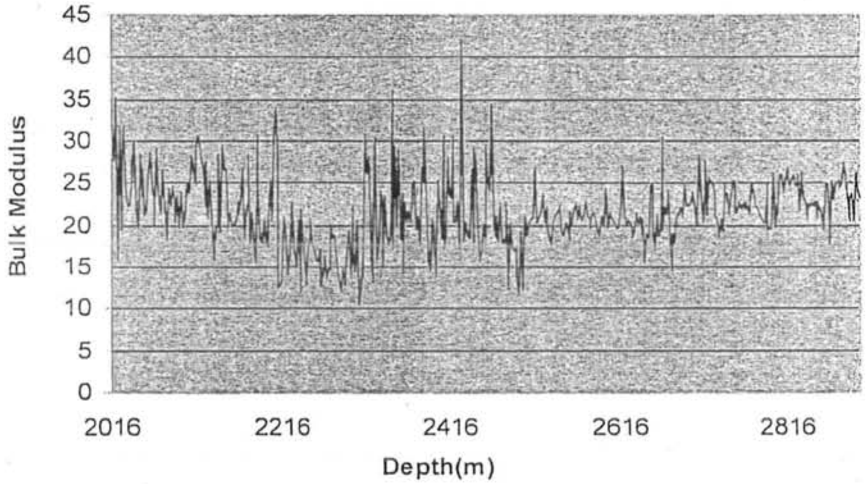


Fig 4.21 Bulk Modulus Vs Depth

4.9.4 THE SHEAR MODULUS

Shear waves are more anomalous than compressional waves. But in the case of fluids present in rocks, P-Waves become more anomalous than S-waves because S-waves cannot pass through fluids and only pass through rock units. But P-Waves pass through both rock and fluid and hence more anomalous.

Estimation of Shear Modulus from shear wave velocity and density have been done by using the formula

$$\mu = \rho * Vs^2$$

Where μ = Shear Modulus

Reservoir rock is charecterised by low Shear Modulus Fig 4.22 shows that Shear modulus values are low from the depth 2100-2350m and 2460-2700m , but from 2200-2350m and 2460-2700m, volume of shale is high.

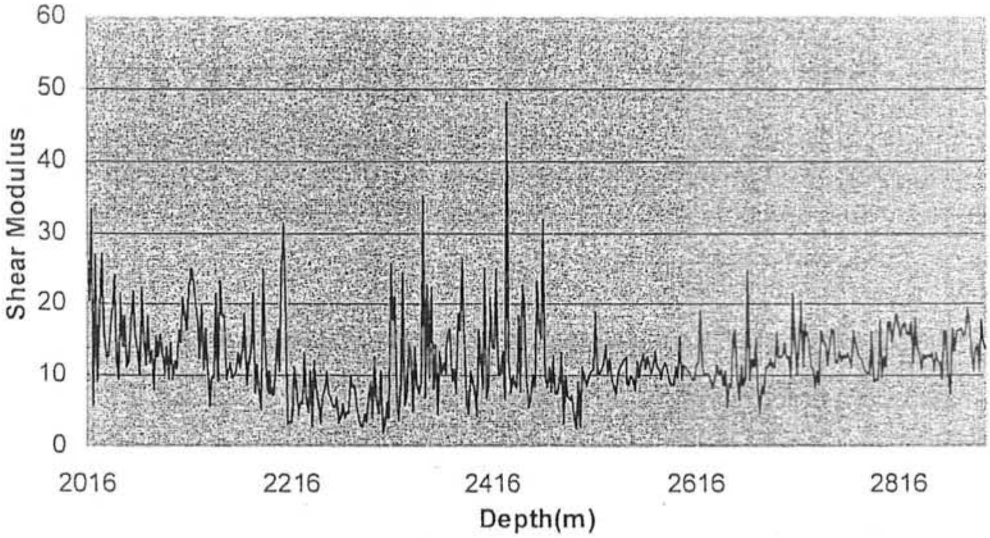


Fig.4.22 Shear Modulus Vs Depth

4.9.5 POISSON RATIO Vs POROSITY

Fig 4.23 shows that Poisson Ratio increases with increasing porosity.

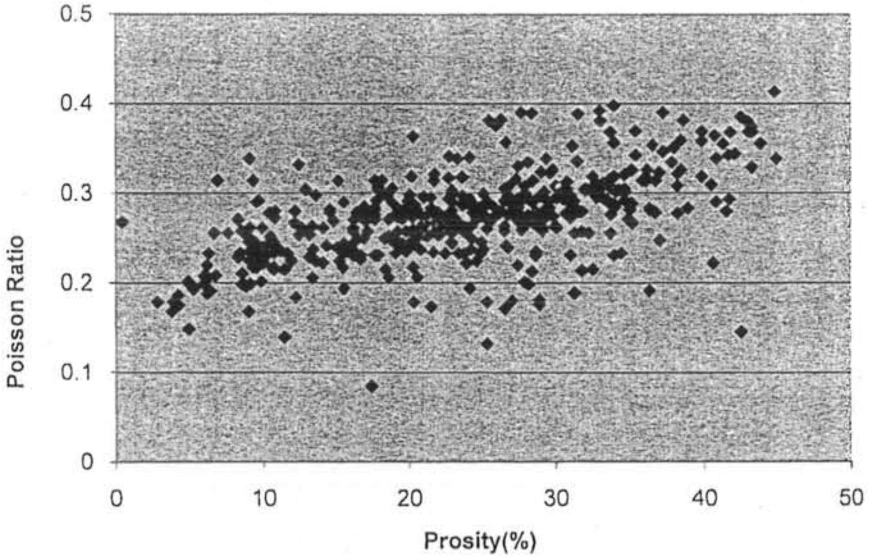


Fig 4.23 Poisson Ratio Vs Porosity.

4.9.6 THE POISSON RATIO

Poisson's Ratio is defined as the transverse strain divided by longitudinal strain. This means that it is the measure of incompressibility of the rock body. Poisson ratio is more dependent on P-Wave velocity rather than S-wave velocity.

Poisson ratio is calculated by using the formula:

$\sigma = ((0.5 * (Vp^2 - 2Vs^2) / (Vp^2 - Vs^2))$ Khan,et al.(2010)

In other words we can say that the Poisson ratio is the measure of the behavior of seismic waves when they passé through the rock body. Reservoir is marked by high Poisson's Ratio. Fig 4.24 shows that Poisson Ratio is high from the depth 2200-2350m and 2460-2650m, This zone have high shale content. From depth 2016-2200m and 2650-2900m Poisson,s Ratio round about 0.25.

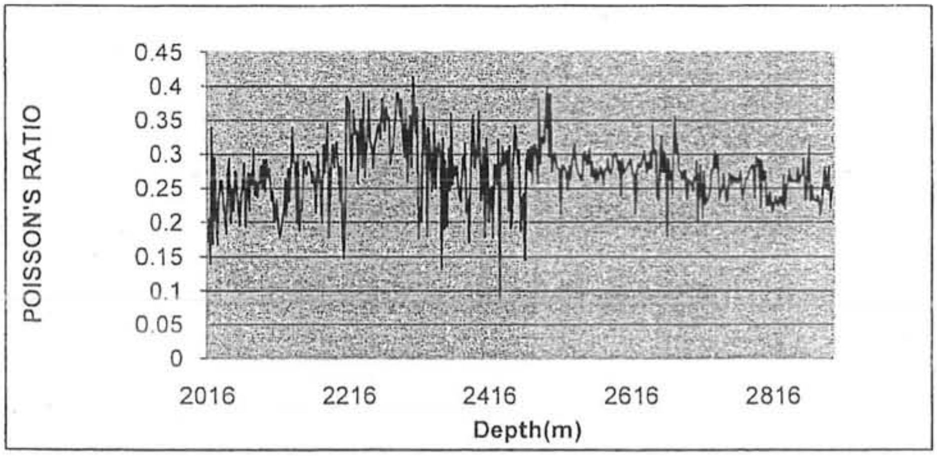


Fig 4.24 Poisson Ratio Vs Depth

4.9.7 P-WAVE AND S-WAVE IMPEDENCE Vs DEPTH

Reservoir rock is charecterised by low both P-Wave and S-Wave Impedence are low. Fig 4.25 shows low impedences from the depth 2100-2400m and 2460-2700m, but these zones have high shale conten.

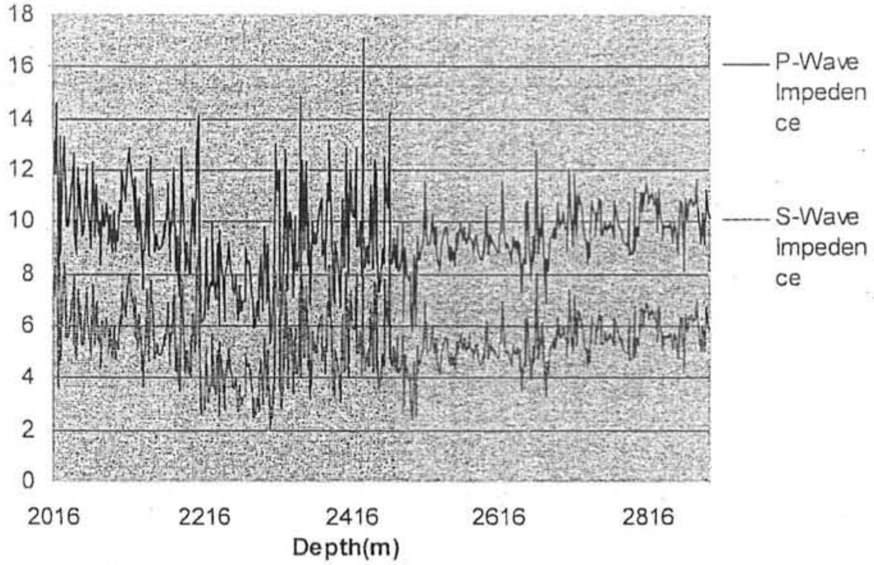


Fig 4.25 P-Wave and S-Wave Impedence Vs Deapth

PETROPHYSICAL ANALYSIS

4.10.1 VOLUME OF SHALE

Shale has high Porosity, so separation of shale from reservoir unit is necessary, and it is more difficult task when small beds of sands are present in reservoir unit. In lower Goru there are thin beds of sand are present.

Three zone are encircled from remaining unit on the basis of volume of shale,from depth 2016-2176m, 2716-2730m and 2808-2838m as shown in Fig.4.26

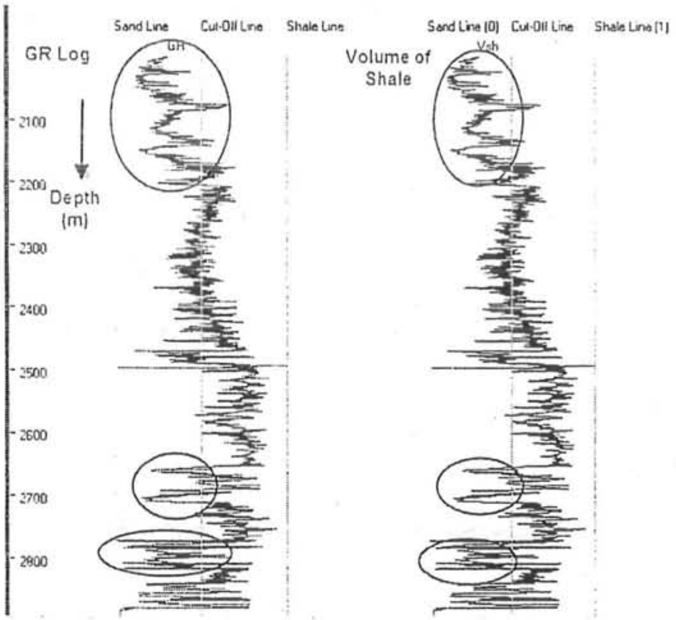


Fig: 4.26 Depth Vs Volume of shale

This graph is generated using Wavelet software. K-Tron,et al.(2010)

Volume of shale is estimated from Gamma Ray Log and is calculated by equation as given below:

$V_{sh}=(GR_{log} - GR_{min})/(GR_{max} - GR_{min})$
V_{sh}= Vloume of shale
GR_{log}= Value from GR Log
GR_{min}= Minimum value of GR
GR_{max}=Maximum value of GR

The result of volume of shale is shown in Apendix#1. Average Volume of shale in encircled zones is 26%. and it is suitable for reservoir unit.

4.10.2 THE POROSITY Vs DEPTH

Porosity is the percentage of voids to the volume of rock. NHPI Log is used for petrophysical analysis. It is very impartant parameter for reservoir, more thin 15% Porosity is good for reservoir rock. Porosity Vs Depth Graph is shown in Fig:4.27

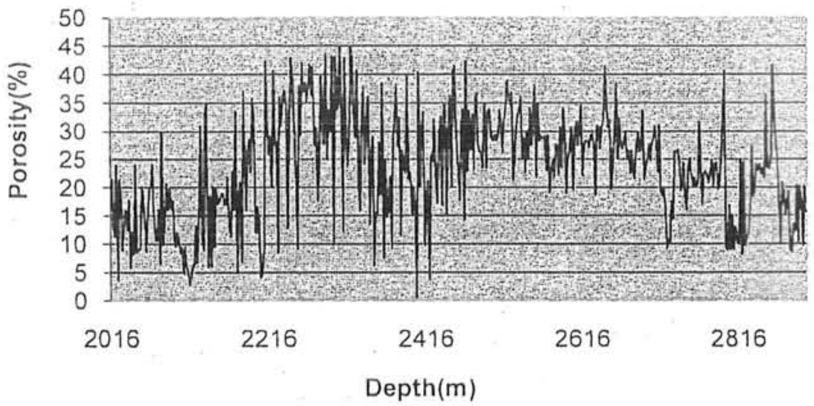


Fig: 4.27 Porosity Vs Depth

Fig 4.27 shows that from depth 2200-2400m and 2460-2700m Porosity is high but these zones have high shale content.

CONCLUSIONS

Four Reflectors were marked for both lines according to statigraphic column of the area.

- Kirther
- Upper Goru
- Basal Sand
- Chiltan

Interpreted seismic Section shows Horst and Graben structures which may be favourable for hydrocarbon accumulation.Time and Depth Surface Contour Map also prepared which shows Horst and Graban.

Rock Physics Analysis of Lower Goru shows that there is no potential zone exist. For reservoir these properties (P -Wave and S-Wave Velocity, P-Wave and S-Wave Impedence, Shear and Bulk Modulus) must be low in reservoir, but these are high in Sand, so probably there is no reservoir zone exist.

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- www.googlemap .com

APPENDIX 1

Depth(m)	DT	Vp(ft/sec)	Vp(m/sec)	Vp(km/sec	Rhob(g/cc	Vs(km/sec	Vs(m/sec)	Shear Mo	Bulk Modu	Lame's C	Young Mo	Poisson's	P-Wave Im	S-Wave I	Vp Vs Ra	Prosity	Vsh
2016	60.67284	16481.84	5023.726	5.023726	2.09881	3.158384	3158.384	20.93645	25.1239	11.16627	49.15521	0.173204	10.54384	6.628847	1.5906	21.45418	0.094602
2018	65.89049	15176.7	4625.914	4.625914	2.288008	2.815443	2815.443	18.13639	24.83985	12.74892	43.75917	0.205816	10.58413	6.441755	1.64305	13.32669	0.044924
2020	55.86345	17900.79	5456.227	5.456227	2.683469	3.531231	3531.231	33.46175	35.38385	13.07602	76.32547	0.139625	14.64162	9.475947	1.545135	11.41434	0.202867
2022	96.0241	10414.05	3174.242	3.174242	2.512826	1.564002	1564.002	6.146626	17.14375	13.046	16.47136	0.339699	7.976317	3.930064	2.029564	24.08367	0.248341
2024	59.87952	16700.2	5090.283	5.090283	2.221884	3.215761	3215.761	22.97677	27.01209	11.69425	53.70342	0.167912	11.31002	7.145049	1.582917	3.76494	0.07357
2026	83.9759	11908.18	3629.657	3.629657	2.34026	1.956601	1956.601	8.959184	18.91582	12.94303	23.21277	0.295194	8.49434	4.578954	1.855083	21.45418	0.36267
2028	67.51004	14812.61	4514.939	4.514939	2.538438	2.719775	2719.775	18.77727	26.77145	14.25327	45.65727	0.215219	11.46089	6.903979	1.660041	18.34661	0.312796
2030	59.87952	16700.2	5090.283	5.090283	2.576428	3.215761	3215.761	26.64315	31.32239	13.56028	62.27282	0.167912	13.11475	8.285178	1.582917	8.976591	0.01939
2032	71.5261	13980.91	4261.433	4.261433	2.320096	2.501235	2501.235	14.51494	22.82765	13.15102	35.92955	0.237216	9.886935	5.803107	1.703731	13.39047	0.000826
2034	76.34538	13098.37	3992.432	3.992432	2.422318	2.269338	2269.338	12.47468	22.01924	13.70279	31.47932	0.26135	9.670939	5.497058	1.759294	16.13753	5.81E-09
2036	76.32743	13101.45	3993.371	3.993371	2.330193	2.270147	2270.147	12.00881	21.1879	13.18202	30.30167	0.261264	9.305325	5.289881	1.75908	12.60956	0.019069
2038	70.32129	14220.45	4334.444	4.334444	2.364637	2.564176	2564.176	15.54749	23.74724	13.38225	38.28689	0.230807	10.24939	6.063345	1.690385	17.86853	0.016127
2040	66.25664	15092.83	4600.349	4.600349	2.554242	2.793405	2793.405	19.93103	27.5477	14.26035	48.17478	0.20797	11.7504	7.13503	1.646861	5.916335	0.178308
2042	62.28916	16054.16	4893.367	4.893367	2.446602	3.046006	3046.006	22.69995	28.39306	13.25976	53.77027	0.183704	11.97212	7.452366	1.606486	12.16384	0.008138
2044	78.35341	12762.69	3890.114	3.890114	2.539919	2.181133	2181.133	12.08326	22.36583	14.31032	30.71794	0.270745	9.880576	5.539901	1.783529	8.311063	0.018522
2046	83.56653	11966.51	3647.438	3.647438	2.338591	1.971929	1971.929	9.09362	19.01763	12.95522	23.53037	0.293501	8.529863	4.611535	1.84968	24.08367	0.312402
2048	64.6988	15456.24	4711.119	4.711119	2.571265	2.888895	2888.895	21.45905	28.52776	14.22173	51.4713	0.198687	12.11353	7.428115	1.630768	8.545817	0.242003
2050	73.85819	13539.46	4126.878	4.126878	2.500799	2.385239	2385.239	14.22796	23.66822	14.18291	35.55863	0.249185	10.32049	5.965004	1.730173	9.044205	0.036585
2052	67.91165	14725.01	4488.239	4.488239	2.372538	2.696758	2696.758	17.25429	24.84489	13.34203	42.0326	0.217502	10.64852	6.398161	1.664309	9.262948	0.223952
2054	79.15663	12633.18	3850.64	3.85064	2.479295	2.147104	2147.104	11.42968	21.56009	13.9403	29.13975	0.274401	9.546873	5.323303	1.793411	20.25575	0.124388
2056	78.35341	12762.69	3890.114	3.890114	2.336875	2.181133	2181.133	11.11731	20.57788	13.16634	28.2623	0.270745	9.090709	5.097034	1.783529	18.58566	0.369025
2058	68.71486	14552.89	4435.776	4.435776	2.390523	2.651531	2651.531	16.80685	24.68308	13.47851	41.09359	0.222011	10.60382	6.338546	1.672911	14.04382	0.382079
2060	64.29719	15552.78	4740.545	4.740545	2.426062	2.914263	2914.263	20.60437	27.11651	13.38027	49.32099	0.196244	11.50086	7.070182	1.62667	8.784861	0.146295
2062	71.92771	13902.85	4237.639	4.237639	2.406498	2.480724	2480.724	14.80957	23.51818	13.64514	36.72089	0.239317	10.19787	5.969857	1.708227	15	0.344965
2064	75.56356	13233.89	4033.739	4.033739	2.374797	2.304948	2304.948	12.61678	21.86012	13.44893	31.74335	0.25759	9.57931	5.473782	1.750035	19.78377	0.376134
2066	82.0218	12191.88	3716.131	3.716131	2.570149	2.031147	2031.147	10.6033	21.39041	14.32154	27.29914	0.286993	9.55101	5.220351	1.829572	20.39773	0.108595
2068	63.89558	15650.53	4770.341	4.770341	2.288168	2.939949	2939.949	19.77733	25.76606	12.58118	47.2442	0.193779	10.91534	6.727099	1.622593	24.08367	0.121192
2070	72.81082	13734.22	4186.242	4.186242	2.542777	2.436415	2436.415	15.09423	24.48588	14.42306	37.56397	0.243879	10.64468	6.195262	1.718197	15.47809	0.461797
2072	78.7401	12700.01	3871.01	3.87101	2.539975	2.164664	2164.664	11.90174	22.2315	14.29701	30.29841	0.272512	9.832269	5.498192	1.788273	10.74087	0.266995
2074	67.91165	14725.01	4488.239	4.488239	2.546763	2.696758	2696.758	18.52134	26.66935	14.32179	45.11922	0.217502	11.43048	6.868003	1.664309	10.69721	0.237778
2076	78.35341	12762.69	3890.114	3.890114	2.467412	2.181133	2181.133	11.73832	21.72735	13.90181	29.84103	0.270745	9.598514	5.381753	1.783529	16.17938	0.399507
2078	75.14056	13308.39	4056.447	4.056447	2.532255	2.324523	2324.523	13.68281	23.46952	14.34765	34.36928	0.255532	10.27196	5.886285	1.745066	6.633466	0.29125
2080	87.18876	11469.37	3495.906	3.495906	2.361885	1.841298	1841.298	8.007687	18.21522	12.87676	20.95269	0.308041	8.256928	4.348935	1.898609	30.02465	0.749156
2082	71.92771	13902.85	4237.639	4.237639	2.457821	2.480724	2480.724	15.12541	24.01975	13.93615	37.50404	0.239317	10.41536	6.097175	1.708227	9.98008	0.592219
2084	76.34538	13098.37	3992.432	3.992432	2.403394	2.269338	2269.338	12.37722	21.84721	13.59573	31.23339	0.26135	9.595385	5.454111	1.759294	14.04382	0.73131
2086	71.5261	13980.91	4261.433	4.261433	2.57942	2.501235	2501.235	16.13731	25.37916	14.62095	39.9455	0.237216	10.99203	6.451736	1.703731	20.73705	0.653406
2088	75.54217	13237.64	4034.882	4.034882	2.544397	2.305932	2305.932	13.52938	23.42938	14.4098	34.03662	0.257487	10.26634	5.867206	1.749783	16.11991	0.261057
2090	81.16466	12320.63	3755.375	3.755375	2.573904	2.064978	2064.978	10.97547	21.70198	14.38499	28.17647	0.283298	9.665975	5.315056	1.818603	19.74932	0.346412
2092	73.89153	13533.35	4125.015	4.125015	2.619779	2.383634	2383.634	14.88483	24.78069	14.85747	37.20523	0.249352	10.80663	6.244595	1.730557	16.43426	0.315184
2094	83.17269	12023.18	3664.709	3.664709	2.595373	1.986818	1986.818	10.24509	21.23012	14.40006	26.47635	0.291859	9.511286	5.156534	1.844512	17.74764	0.21066
2096	73.13253	13673.81	4167.827	4.167827	2.649538	2.42054	2420.54	15.52368	25.37804	15.02892	38.68351	0.245521	11.04281	6.413313	1.721858	10.69721	0.352473
2098	83.17269	12023.18	3664.709	3.664709	2.649458	1.986818	1986.818	10.45859	21.67254	14.70014	27.0281	0.291859	9.709493	5.263991	1.844512	9.686833	0.227433
2100	77.5502	12894.87	3930.405	3.930405	2.659879	2.215866	2215.866	13.06018	23.72	15.01322	33.10473	0.267031	10.4544	5.893937	1.773755	12.08802	0.358609
2102	79.95984	12506.28	3811.96	3.81196	2.670238	2.113759	2113.759	11.93056	22.93369	14.97999	30.50236	0.278001	10.17884	5.644239	1.803404	10.39814	0.2669
2104	70.72289	14139.69	4309.831	4.309831	2.646971	2.542958	2542.958	17.11699	26.40094	14.98961	42.2254	0.23296	11.408	6.731136	1.69481	8.419667	0.210218
2106	73.13253	13673.81	4167.827	4.167827	2.63331	2.42054	2420.54	15.4286	25.22261	14.93687	38.44659	0.245521	10.97518	6.374034	1.721858	9.389381	0.239795
2108	65.1004	15360.89	4682.056	4.682056	2.678284	2.863841	2863.841	21.96618	29.49738	14.85326	52.79369	0.20111	12.53988	7.67018	1.634887	4.887814	0.157887
2110	67.90731	14725.96	4488.526	4.488526	2.643665	2.697005	2697.005	19.22959	27.68621	14.86649	46.84361	0.217478	11.86616	7.129978	1.664263	9.533576	0.257383
2112	70.72289	14139.69	4309.831	4.309831	2.658947	2.542958	2542.958	17.19444	26.52039	15.05743	42.41645	0.23296	11.45961	6.761591	1.69481	6.265854	0.201116
2114	63.75853	15684.17	4780.595	4.780595	2.671701	2.948788	2948.788	23.23138	30.16154	14.67395	55.45612	0.192933	12.77232	7.878281	1.621205	5.205693	0.146493
2116	61.48594	16263.88	4957.291	4.957291	2.685852	3.101113	3101.113	25.82957	31.65076	14.43105	60.91751	0.178533	13.31455	8.329129	1.598552	2.808765	0.108742
2118	62.66345	15958.27	4864.139	4.864139	2.677995	3.020809	3020.809	24.43748	30.85911	14.56745	58.0018	0.186083	13.02614	8.089712	1.61021	4.203953	0.163647
2120	65.90361	15173.67	4624.992	4.624992	2.6906	2.614648	2614.648	21.31559	29.20368	14.99328	51.43318	0.205893	12.444	7.573092	1.643186	6.238183	0.168531
2122	68.31325	14638.45	4461.853	4.461853	2.686156	2.674011	2674.011	19.20692	27.93115	15.12654	46.87597	0.219766	11.98523	7.182812	1.668599	6.143849	0.166196

2124	76.74699	13029.83	3971.54	3.97154	2.634686	2.251327	2251.327	13.35384	23.79663	14.89407	33.74866	0.263258	10.46376	5.93154	1.764088	13.32669	0.340581
2126	66.30522	15081.77	4596.979	4.596979	2.678019	2.790499	2790.499	20.85343	28.85742	14.95513	50.4161	0.208254	12.3108	7.473009	1.647368	6.752138	0.180799
2128	79.95984	12506.28	3811.96	3.81196	2.638743	2.113759	2113.759	11.78984	22.66319	14.8033	30.14259	0.278001	10.05878	5.577665	1.803404	16.37607	0.393744
2130	70.32129	14220.45	4334.444	4.334444	2.495167	2.564176	2564.176	16.40572	25.05811	14.12096	40.40036	0.230807	10.81516	6.398047	1.690385	30.99176	0.476721
2132	80.36145	12443.78	3792.91	3.79291	2.663882	2.097336	2097.336	11.71793	22.73819	14.92624	30.00033	0.27978	10.10386	5.587055	1.808442	10.78289	0.313173
2134	95.68375	10451.1	3185.533	3.185533	2.262269	1.573735	1573.735	5.602831	15.50488	11.76966	15.00151	0.338571	7.206532	3.560212	2.024186	9.023904	0.270601
2136	82.90718	12061.68	3676.445	3.676445	2.248715	1.996936	1996.936	8.967316	18.46766	12.48945	23.15428	0.290746	8.267276	4.490538	1.841043	33.40637	0.660776
2138	82.36948	12140.42	3700.445	3.700445	2.351577	2.017625	2017.625	9.572822	19.46897	13.08709	24.67437	0.288474	8.70188	4.744599	1.83406	35.07968	0.639606
2140	64.6988	15456.24	4711.119	4.711119	2.61607	2.888895	2888.895	21.83298	29.02486	14.46955	52.36819	0.198687	12.32461	7.557551	1.630768	5.916335	0.508306
2142	84.37751	11851.5	3612.381	3.612381	2.447751	1.941708	1941.708	9.22858	19.66741	13.51503	23.9411	0.296842	8.842208	4.752817	1.860414	18.49497	0.380408
2144	63.0282	15865.91	4835.99	4.83599	2.473195	2.996543	2996.543	22.20748	28.30415	13.49916	52.81066	0.188383	11.96034	7.411034	1.613856	6.155378	0.186045
2146	67.91165	14725.01	4488.239	4.488239	2.483941	2.696758	2696.758	18.06447	26.01149	13.96851	44.00625	0.217502	11.14852	6.698588	1.664309	20.25896	0.623417
2148	67.91165	14725.01	4488.239	4.488239	2.484186	2.696758	2696.758	18.06625	26.01405	13.96988	44.01058	0.217502	11.14962	6.699247	1.664309	9.510539	0.108098
2150	83.17269	12023.18	3664.709	3.664709	2.328841	1.986818	1986.818	9.192973	19.04989	12.92124	23.75736	0.291859	8.534523	4.626983	1.844512	19.90543	0.059874
2152	80.32709	12449.1	3794.532	3.794532	2.304173	2.098734	2098.734	10.14916	19.67819	12.91208	25.98087	0.279629	8.743257	4.835847	1.80801	17.20274	0.006403
2154	78.35341	12762.69	3890.114	3.890114	2.299902	2.181133	2181.133	10.94142	20.2523	12.95803	27.81515	0.270745	8.946881	5.016391	1.783529	17.62907	0.038355
2156	82.33849	12144.99	3701.838	3.701838	2.294229	2.018826	2018.826	9.350489	19.00305	12.76939	24.09884	0.288342	8.492863	4.631648	1.833659	18.90812	0.059836
2158	81.97225	12199.25	3718.377	3.718377	2.296807	2.033083	2033.083	9.493684	19.12979	12.80067	24.43832	0.286781	8.540392	4.669599	1.828935	18.99825	0.315719
2160	80.76305	12381.9	3774.049	3.774049	2.361209	2.081077	2081.077	10.22611	20.03102	13.21361	26.21696	0.281546	8.911318	4.913857	1.813508	17.07476	0.136634
2162	75.54217	13237.64	4034.882	4.034882	2.429836	2.305932	2305.932	12.92022	22.37448	13.761	32.50413	0.257487	9.804099	5.603037	1.749783	17.15139	0.415302
2164	79.1744	12630.35	3849.776	3.849776	2.449139	2.146359	2146.359	11.28283	21.29198	13.77009	28.76716	0.274482	9.428638	5.256731	1.793631	21.93227	0.125972
2166	74.73896	13379.9	4078.244	4.078244	2.435592	2.343314	2343.314	13.37413	22.72135	13.80527	33.54139	0.253562	9.932937	5.707356	1.740375	13.12694	0.506096
2168	67.51004	14812.61	4514.939	4.514939	2.404772	2.719775	2719.775	17.78852	25.36176	13.50275	43.25311	0.215219	10.8574	6.540439	1.660041	11.41434	0.241401
2170	85.98394	11630.08	3544.891	3.544891	2.57156	1.883527	1883.527	9.123058	20.18122	14.09918	23.7851	0.303313	9.115902	4.843603	1.88205	22.88845	0.363374
2172	78.35341	12762.69	3890.114	3.890114	2.425124	2.181133	2181.133	11.53714	21.35497	13.66355	29.3296	0.270745	9.434009	5.289518	1.783529	16.19522	0.28819
2174	75.14056	13308.39	4056.447	4.056447	2.366807	2.324523	2324.523	12.78883	21.93611	13.41023	32.12373	0.255532	9.600829	5.501699	1.745066	33.64542	0.309896
2176	64.6988	15456.24	4711.119	4.711119	2.604849	2.888895	2888.895	21.73933	28.90037	14.40748	52.14357	0.198687	12.27175	7.525135	1.630768	4.960159	0.362383
2178	88.79518	11261.87	3432.66	3.43266	2.345028	1.786776	1786.776	7.486663	17.67457	12.68346	19.68112	0.314182	8.049684	4.19004	1.921147	16.10757	0.717398
2180	78.75502	12697.6	3870.277	3.870277	2.385096	2.164031	2164.031	11.16948	20.87104	13.42472	28.43581	0.27258	9.23098	5.161422	1.788457	20.9761	0.82354
2182	88.79518	11261.87	3432.66	3.43266	2.087744	1.786776	1786.776	6.665267	15.73541	11.2919	17.52181	0.314182	7.166515	3.730331	1.921147	6.876274	0.689554
2184	98.03213	10200.74	3109.223	3.109223	2.503606	1.50795	1507.95	5.692987	16.63135	12.83603	15.32981	0.346219	7.784268	3.775314	2.061886	37.23108	0.718068
2186	61.48594	16263.88	4957.291	4.957291	2.055056	3.101113	3101.113	19.76327	24.2173	11.04179	46.6105	0.178533	10.18751	6.372961	1.598552	25.27888	0.679274
2188	71.5261	13980.91	4261.433	4.261433	2.493504	2.501235	2501.235	15.59981	24.53382	14.13395	38.61499	0.237216	10.6259	6.236841	1.703731	16.07391	0.757453
2190	86.99255	11495.24	3503.791	3.503791	2.332744	1.848096	1848.096	7.967389	18.04143	12.72983	20.83512	0.307278	8.173447	4.311134	1.895893	26.73283	0.693206
2192	88.79518	11261.87	3432.66	3.43266	2.164392	1.786776	1786.776	6.909972	16.31311	11.70646	18.1651	0.314182	7.429623	3.867284	1.921147	28.4487	0.649924
2194	80.53693	12416.66	3784.645	3.784645	2.279943	2.090211	2090.211	9.961032	19.40868	12.76799	25.51766	0.280554	8.628774	4.765562	1.810652	22.84329	0.687964
2196	88.79518	11261.87	3432.66	3.43266	2.295663	1.786776	1786.776	7.329064	17.30251	12.41646	19.26682	0.314182	7.880232	4.101837	1.921147	35.79681	0.636657
2198	90	11111.11	3386.708	3.386708	2.30989	1.747162	1747.162	7.051113	17.11598	12.41523	18.59928	0.318671	7.822924	4.035752	1.938405	32.4502	0.379338
2200	80.36145	12443.78	3792.91	3.79291	2.532269	2.097336	2097.336	11.13899	21.61478	14.18879	28.51812	0.27978	9.604669	5.31102	1.808442	12.13147	0.604525
2202	70.32129	14220.45	4334.444	4.334444	2.569926	2.564176	2564.176	16.89726	25.80889	14.54405	41.61082	0.230807	11.1392	6.589742	1.690385	16.67331	0.513527
2204	80.74363	12384.88	3774.957	3.774957	2.508555	2.081859	2081.859	10.87243	21.28734	14.03905	27.87209	0.281461	9.469688	5.222459	1.813262	14.52191	0.490394
2206	60.96224	16403.6	4999.877	4.999877	2.334719	3.137825	3137.825	22.98751	27.7917	12.46669	54.05807	0.175112	11.67331	7.325938	1.593421	4.243028	0.165756
2208	57.06827	17522.87	5341.036	5.341036	2.615882	3.431928	3431.928	30.81019	33.64484	13.10471	70.8145	0.148383	13.97152	8.977518	1.556279	4.895859	0.152344
2210	64.6988	15456.24	4711.119	4.711119	2.592675	2.888895	2888.895	21.6394	28.76753	14.34126	51.90389	0.198687	12.21534	7.490546	1.630768	9.05037	0.236542
2212	111.6867	8953.614	2729.095	2.729095	2.35959	1.180254	1180.254	3.286908	13.20254	11.01127	9.105119	0.38497	6.439544	2.784916	2.312294	42.49004	0.756048
2214	110.0803	9084.276	2768.921	2.768921	2.179224	1.214587	1214.587	3.214839	12.43221	10.28898	8.879164	0.380871	6.0341	2.646858	2.279722	32.97723	0.785268
2216	108.0723	9253.066	2820.369	2.820369	2.086154	1.258939	1258.939	3.306401	12.19676	9.992492	9.097158	0.375586	5.883724	2.62634	2.240275	25.89739	0.640887
2218	79.55823	12569.41	3831.203	3.831203	2.512513	2.130347	2130.347	11.40273	21.71331	14.11149	29.11213	0.276208	9.625946	5.352524	1.798394	29.10359	0.572187
2220	84.70459	11805.74	3598.432	3.598432	1.997136	1.929683	1929.683	7.436687	15.96955	11.01176	19.31228	0.298176	7.186559	3.853839	1.864779	20.05274	0.638842
2222	103.9998	9615.399	2930.809	2.930809	2.133177	1.354146	1354.146	3.91163	13.12076	10.51301	10.67415	0.364289	6.251934	2.888633	2.164323	40.75051	0.752406
2224	93.21285	10728.13	3269.975	3.269975	2.247164	1.64653	1646.53	6.092201	15.92571	11.86424	16.20966	0.33017	7.34817	3.700024	1.985979	27.43028	0.705277
2226	94.44353	10588.34	3227.365	3.227365	2.118418	1.609797	1609.797	5.489767	14.7638	11.10396	14.6531	0.3344	6.836908	3.410223	2.004827	28.14741	0.528904
2228	75.54217	13237.64	4034.882	4.034882	2.280625	2.305932	2305.932	12.12682	21.00051	12.91597	30.50812	0.257487	9.20205	5.258966	1.749783	8.545817	0.424295
2230	92.00803	10868.62	3312.795	3.312795	2.292007	1.683444	1683.444	6.495509	16.51486	12.18452	17.22788	0.325936	7.59295	3.858465	1.967868	36.12066	0.738426
2232	100.0402	9995.986	3046.813	3.046813	2.28762	1.45415	1454.15	4.837289	14.80255	11.57769	13.08638	0.352511	6.969951	3.326541	2.095255	31.14202	0.47463
2234	80.76305	12381.9	3774.049	3.774049	2.315597	2.081077	2081.077	10.02857	19.64407	12.95836	25.71052	0.281546	8.739175	4.816934	1.813508	36.2749	0.777582

2236	113.6948	8795.479	2680.894	2.680894	2.142805	1.138702	1138.702	2.778452	11.70541	9.853113	7.724204	0.389939	5.744633	2.440016	2.354342	37.23238	0.857412
2238	77.5502	12894.87	3930.405	3.930405	2.366868	2.215866	2215.866	11.62148	21.10702	13.35937	29.45794	0.267031	9.302752	5.244664	1.773755	35.07968	0.605168
2240	86.1598	11606.34	3537.656	3.537656	2.41449	1.877289	1877.289	8.509183	18.90015	13.22736	22.19647	0.30401	8.541635	4.532697	1.884449	12.84861	0.784355
2242	94.81928	10546.38	3214.575	3.214575	2.070722	1.598772	1598.772	5.292912	14.35822	10.82961	14.14111	0.335674	6.656491	3.310611	2.010653	31.44227	0.642575
2244	109.6787	9117.539	2779.06	2.77906	2.12754	1.223327	1223.327	3.183928	12.19674	10.07412	8.787161	0.379829	5.912561	2.602678	2.271722	42.96813	0.613042
2246	90	11111.11	3386.708	3.386708	2.136772	1.747162	1747.162	6.522655	15.83319	11.48475	17.20533	0.318671	7.236621	3.733286	1.938405	39.86056	0.673807
2248	86.90207	11507.21	3507.439	3.507439	2.112713	1.851241	1851.241	7.240463	16.36106	11.53408	18.92908	0.306925	7.410214	3.911141	1.894642	30.05976	0.566511
2250	80.36145	12443.78	3792.91	3.79291	1.969467	2.097336	2097.336	8.663328	16.81085	11.0353	22.17991	0.27978	7.470011	4.130634	1.808442	19.54183	0.628654
2252	88.79518	11261.87	3432.66	3.43266	2.653629	1.786776	1786.776	8.471896	20.00051	14.35258	22.27112	0.314182	9.109009	4.741442	1.921147	9.262948	0.694827
2254	90.80321	11012.83	3356.75	3.35675	2.146073	1.721336	1721.336	6.358813	15.72424	11.48503	16.81042	0.321609	7.203832	3.694114	1.950084	38.18725	0.680381
2256	95.62249	10457.79	3187.573	3.187573	1.984584	1.575494	1575.494	4.9261	13.6129	10.32883	13.18757	0.338367	6.326008	3.126701	2.023221	29.34263	0.655413
2258	97.22892	10285.01	3134.908	3.134908	2.246958	1.530093	1530.093	5.260544	15.08579	11.57876	14.13825	0.343639	7.044006	3.438055	2.048835	42.09991	0.595607
2260	91.20482	10964.33	3341.969	3.341969	2.268909	1.708594	1708.594	6.623613	16.53149	12.11575	17.52966	0.323062	7.562624	3.876645	1.955976	36.99203	0.704897
2262	110.1666	9077.16	2766.752	2.766752	2.309497	1.212717	1212.717	3.396538	13.16161	10.89725	9.382517	0.381094	6.389805	2.800767	2.281449	38.60695	0.608276
2264	105.6627	9464.082	2884.687	2.884687	2.017368	1.314386	1314.386	3.485224	12.15202	9.828538	9.543325	0.368998	5.819476	2.6516	2.194704	35.31873	0.647318
2266	94.41767	10591.24	3228.249	3.228249	2.276534	1.610559	1610.559	5.905104	15.87132	11.93458	15.76067	0.334312	7.349219	3.666493	2.004427	37.79929	0.569768
2268	105.261	9500.191	2895.693	2.895693	1.972899	1.323874	1323.874	3.457785	11.94399	9.638797	9.460424	0.367873	5.712912	2.61187	2.187288	41.77291	0.607454
2270	100.4418	9956.018	3034.631	3.034631	2.24097	1.443647	1443.647	4.670445	14.42536	11.31173	12.6465	0.353743	6.800516	3.23517	2.102058	36.51394	0.707855
2272	100.8801	9912.758	3021.445	3.021445	2.027066	1.43228	1432.28	4.158379	12.97471	10.20246	11.27102	0.355078	6.124669	2.903327	2.109535	41.29006	0.447368
2274	81.96787	12199.9	3718.575	3.718575	2.016182	2.033255	2033.255	8.335149	16.79362	11.23686	21.45575	0.286762	7.497326	4.099412	1.828878	27.43028	0.647796
2276	86.38554	11576.01	3528.411	3.528411	1.975429	1.86932	1869.32	6.902853	15.41267	10.81077	18.01857	0.304901	6.970124	3.692708	1.887537	30.73265	0.487002
2278	85.98394	11630.08	3544.891	3.544891	2.521164	1.883527	1883.527	8.944269	19.78571	13.82287	23.31897	0.303313	8.937253	4.748681	1.88205	17.86853	0.590496
2280	95.62249	10457.79	3187.573	3.187573	1.967605	1.575494	1575.494	4.883953	13.49643	10.24046	13.07474	0.338367	6.271884	3.09995	2.023221	23.24726	0.499588
2282	105.6094	9468.858	2886.143	2.886143	1.966459	1.31564	1315.64	3.403763	11.85325	9.58407	9.319253	0.368849	5.675481	2.587153	2.193717	39.86056	0.558193
2284	114.498	8733.778	2662.088	2.662088	1.965307	1.122489	1122.489	2.476253	10.63415	8.983312	6.893674	0.391879	5.23182	2.206036	2.371593	32.92829	0.47894
2286	113.6948	8795.479	2680.894	2.680894	1.964125	1.138702	1138.702	2.546768	10.72935	9.031503	7.080115	0.389939	5.265612	2.236553	2.354342	27.66932	0.59084
2288	100.8434	9916.368	3022.546	3.022546	1.995187	1.433229	1433.229	4.098404	12.77672	10.04445	11.10755	0.354967	6.030544	2.85956	2.108906	43.82821	0.484197
2290	110.0803	9084.276	2768.921	2.768921	1.956783	1.214587	1214.587	2.886688	11.16321	9.238749	7.972834	0.380871	5.418177	2.376683	2.279722	25.43312	0.477832
2292	90	11111.11	3386.708	3.386708	1.959867	1.747162	1747.162	5.98264	14.52235	10.53392	15.78089	0.318671	6.637497	3.424205	1.938405	33.88446	0.461546
2294	83.9759	11908.16	3629.657	3.629657	1.971814	1.956601	1956.601	7.548666	15.93775	10.90531	19.55819	0.295194	7.157006	3.858052	1.855083	30.05976	0.48188
2296	105.4769	9480.751	2889.768	2.889768	1.97567	1.318765	1318.765	3.435971	11.9285	9.637852	9.404895	0.368478	5.709227	2.605445	2.191268	43.26515	0.702477
2298	76.34538	13098.37	3992.432	3.992432	2.190039	2.269338	2269.338	11.27846	19.90779	12.38881	28.46072	0.26135	8.74358	4.969937	1.759294	9.899984	0.615538
2300	92.9152	10762.5	3280.451	3.280451	1.963889	1.655561	1655.561	5.382787	13.975	10.38648	14.31096	0.329132	6.44244	3.251337	1.981474	43.2189	0.501086
2302	101.245	9877.033	3010.556	3.010556	1.963889	1.422893	1422.893	3.976139	12.51134	9.860582	10.78583	0.356182	5.912398	2.794404	2.115799	33.88446	0.526362
2304	80.79106	12377.61	3772.741	3.772741	1.963889	2.079949	2079.949	8.496151	16.65327	10.98917	21.78389	0.281669	7.409243	4.084788	1.813862	34.94068	0.593336
2306	124.1365	8055.645	2455.391	2.455391	1.963889	0.944302	944.3022	1.751213	9.511061	8.343586	4.949844	0.413211	4.822114	1.854505	2.600217	44.7667	0.399249
2308	113.0562	8845.161	2696.038	2.696038	1.963889	1.151757	1151.757	2.605185	10.80987	9.073078	7.234389	0.388377	5.294719	2.261922	2.340805	31.49402	0.483433
2310	93.61446	10682.11	3255.947	3.255947	2.508419	1.634437	1634.437	6.700951	17.67996	13.21266	17.84797	0.331561	8.167278	4.099852	1.992091	12.37052	0.685991
2312	105.5791	9471.573	2886.97	2.88697	1.967005	1.316354	1316.354	3.408402	11.86102	9.588755	9.331378	0.368764	5.678685	2.589275	2.193157	43.01635	0.396362
2314	61.08434	16370.81	4989.883	4.989883	1.966624	3.12921	3129.21	19.25709	23.35492	10.51685	45.31624	0.175913	9.813226	6.15398	1.594615	28.86454	0.50456
2316	68.71486	14552.89	4435.776	4.435776	2.555148	2.651531	2651.531	17.96427	26.3829	14.40672	43.92354	0.222011	11.33407	6.775055	1.672911	23.85054	0.297059
2318	65.1004	15360.89	4682.056	4.682056	2.348728	2.863841	2863.841	19.2633	25.8678	13.02561	46.29757	0.20111	10.99686	6.726385	1.634887	27.89587	0.505545
2320	95.62249	10457.79	3187.573	3.187573	1.971752	1.575494	1575.494	4.894249	13.52488	10.26205	13.1023	0.338367	6.285105	3.106485	2.023221	44.88048	0.548534
2322	107.5289	9299.826	2834.622	2.834622	2.211577	1.271225	1271.225	3.573939	13.01686	10.63423	9.822825	0.374124	6.268983	2.811413	2.229834	43.20717	0.630007
2324	84.77912	11795.36	3595.269	3.595269	1.913991	1.926956	1926.956	7.106953	15.28792	10.54995	18.46029	0.298478	6.881313	3.688177	1.865776	32.92829	0.277924
2326	61.88755	16158.34	4925.122	4.925122	1.95664	3.073381	3073.381	18.48177	22.88111	10.55993	43.68375	0.18113	9.63669	6.013499	1.602509	28.86454	0.25116
2328	95.75568	10443.25	3183.14	3.18314	2.646677	1.571672	1571.672	6.537699	18.122	13.76353	17.50773	0.33881	8.424743	4.159709	2.02532	40.81673	0.501153
2330	90	11111.11	3386.708	3.386708	1.929858	1.747162	1747.162	5.891036	14.29999	10.37263	15.53925	0.318671	6.535865	3.371774	1.938405	20.14683	0.472739
2332	73.13253	13673.81	4167.827	4.167827	1.955787	2.42054	2420.54	11.45898	18.73309	11.09377	28.55467	0.245521	8.151379	4.73406	1.721858	16.19522	0.51568
2334	75.14056	13308.39	4056.447	4.056447	2.439505	2.324523	2324.523	13.18164	22.60989	13.82213	33.11042	0.255532	9.895721	5.670685	1.745066	31.25498	0.580151
2336	99.54337	10045.87	3062.019	3.062019	2.052686	1.467258	1467.258	4.419546	13.36978	10.42342	11.9427	0.350975	6.285976	3.012113	2.086899	37.94821	0.674291
2338	73.93574	13525.26	4122.549	4.122549	2.069397	2.381508	2381.508	11.73675	19.56037	11.73587	29.34165	0.249573	8.531189	4.928284	1.731067	24.20608	0.549907
2340	85.98394	11630.08	3544.891	3.544891	1.98373	1.883527	1883.527	7.037626	15.56801	10.87626	18.34809	0.303313	7.032108	3.73641	1.88205	32.4502	0.463853
2342	89.3097	11196.99	3412.885	3.412885	1.947805	1.769728	1769.728	6.100404	14.57407	10.50713	16.06037	0.316111	6.647633	3.447085	1.92848	36.16438	0.279162
2344	84.54705	11827.73	3605.137	3.605137	2.331718	1.935463	1935.463	8.734655	18.68828	12.86517	22.6718	0.297534	8.406162	4.512953	1.862674	13.56574	0.675125
2346	54.86317	18227.17	5555.708	5.555706	2.61827	3.616989	3616.989	34.25381	35.25766	12.42179	77.6236	0.132165	14.54634	9.470256	1.536003	25.27888	0.275636

2348	91.31575	10951.01	3337.91	3.33791	1.968254	1.705094	1705.094	5.722397	14.31879	10.50386	15.14911	0.323461	6.569853	3.356059	1.95761	28.99892	0.520996
2350	63.43637	15763.83	4804.873	4.804873	2.617238	2.969718	2969.718	23.08202	29.72459	14.33658	55.0077	0.190935	12.5755	7.772461	1.617956	6.394422	0.334025
2352	82.77108	12081.51	3682.49	3.68249	2.242154	2.002147	2002.147	8.987881	18.45138	12.45946	23.19711	0.290173	8.256711	4.489122	1.839271	15.47809	0.521376
2354	63.90109	15649.18	4769.93	4.76993	2.288722	2.939594	2939.594	19.77734	25.76966	12.58477	47.24556	0.193813	10.91704	6.727914	1.622649	15.47809	0.282475
2356	87.09448	11481.78	3499.69	3.49969	2.574029	1.84456	1844.56	8.757886	19.87829	14.0397	22.90924	0.307674	9.008306	4.747953	1.897303	27.90837	0.547447
2358	73.50689	13604.17	4146.601	4.146601	2.525578	2.402242	2402.242	14.57452	24.04142	14.32508	36.3734	0.247418	10.47256	6.067049	1.726138	18.8247	0.457471
2360	102.3007	9775.104	2979.488	2.979488	1.964002	1.39611	1396.11	3.828083	12.34378	9.791723	10.4083	0.359335	5.85172	2.741963	2.134135	38.41838	0.381096
2362	75.1037	13314.92	4058.438	4.058438	2.471097	2.32624	2326.24	13.37207	22.91638	14.00167	33.58396	0.255352	10.02879	5.748363	1.744635	7.589641	0.46003
2364	81.16466	12320.63	3755.375	3.755375	2.196628	2.064978	2064.978	9.366719	18.52096	12.27648	24.04644	0.283298	8.249162	4.535989	1.818603	25.03984	0.530299
2366	77.95181	12828.44	3910.156	3.910156	1.965638	2.19841	2198.41	9.499942	17.41834	11.08505	24.11562	0.268895	7.68595	4.321278	1.778629	14.76096	0.620755
2368	81.16466	12320.63	3755.375	3.755375	2.568432	2.064978	2064.978	10.95214	21.65584	14.35441	28.11657	0.283298	9.645425	5.303757	1.818603	17.62948	0.589803
2370	74.78144	13372.3	4075.927	4.075927	2.156116	2.341316	2341.316	11.81931	20.10025	12.22071	29.64696	0.253771	8.788171	5.048149	1.74087	21.93215	0.613154
2372	71.06098	14072.42	4289.326	4.289326	2.512175	2.525281	2525.281	16.02025	24.91286	14.23269	39.57733	0.23476	10.77554	6.343947	1.698554	9.262948	0.432482
2374	70.26967	14230.89	4337.628	4.337628	2.033706	2.566921	2566.921	13.40026	20.44187	11.50837	32.99174	0.230528	8.821459	5.220361	1.689818	28.6255	0.548157
2376	83.9759	11908.18	3629.657	3.629657	1.968963	1.956601	1956.601	7.537753	15.91471	10.88954	19.52991	0.295194	7.146659	3.852474	1.855083	32.72264	0.351505
2378	79.85896	12522.08	3816.775	3.816775	2.478796	2.11791	2117.91	11.11874	21.32261	13.91012	28.41687	0.277552	9.461008	5.249867	1.802143	38.18725	0.338145
2380	89.29048	11199.4	3413.619	3.413619	2.428702	1.770361	1770.361	7.611989	18.17723	13.10257	20.03879	0.316039	8.290665	4.299681	1.928205	27.29109	0.248514
2382	67.51004	14812.61	4514.939	4.514939	2.46413	2.719775	2719.775	18.2276	25.98777	13.83604	44.32074	0.215219	11.1254	6.701878	1.660041	32.4502	0.561252
2384	70.72289	14139.69	4309.831	4.309831	2.533247	2.542958	2542.958	16.38158	25.26665	14.3456	40.41123	0.23296	10.91787	6.441939	1.69481	11.60431	0.61524
2386	60.37534	16563.05	5048.48	5.04848	2.37451	3.179724	3179.724	24.00783	28.58909	12.58386	56.27195	0.171231	11.98767	7.550288	1.58771	26.4741	0.660806
2388	71.5261	13980.91	4261.433	4.261433	2.548495	2.501235	2501.235	15.94384	25.07488	14.44565	39.46658	0.237216	10.86024	6.374385	1.703731	24.18832	0.442607
2390	96.4257	10370.68	3161.021	3.161021	1.957399	1.552605	1552.605	4.71847	13.28288	10.13723	12.65673	0.341022	6.187381	3.039067	2.035947	22.69942	0.630421
2392	101.8623	9817.179	2992.313	2.992313	2.064674	1.407166	1407.166	4.088294	13.04952	10.32399	11.10517	0.356032	6.17815	2.905339	2.126482	39.86056	0.485362
2394	80.36145	12443.78	3792.91	3.79291	2.403006	2.097336	2097.336	10.57039	20.51142	13.4645	27.06237	0.27978	9.114384	5.039911	1.808442	21.55123	0.495848
2396	83.5743	11965.4	3647.099	3.647099	2.091899	1.971637	1971.637	8.131949	17.00955	11.58825	21.0425	0.293533	7.629364	4.124466	1.849782	22.67609	0.536076
2398	86.68048	11276.44	3437.101	3.437101	2.060434	1.790604	1790.604	6.606291	15.5549	11.1507	17.36108	0.31375	7.061918	3.689421	1.91952	15.10175	0.484355
2400	103.6546	9647.423	2940.57	2.94057	1.978946	1.362561	1362.561	3.674056	12.22536	9.775994	10.01855	0.363294	5.819231	2.696435	2.158121	20.25896	0.809877
2402	70.43132	14198.23	4327.673	4.327673	1.959208	2.558339	2558.339	12.82321	19.63866	11.08985	31.59327	0.231398	8.478812	5.012318	1.691595	16.0757	0.504445
2404	77.68005	12873.32	3923.835	3.923835	2.127331	2.210203	2210.203	10.392	18.93205	12.00405	26.35401	0.267635	8.347296	4.701832	1.775328	0.418327	0.470746
2406	87.59036	11416.78	3479.877	3.479877	2.228666	1.82748	1827.48	7.44304	17.08888	12.12686	19.4983	0.309593	7.755483	4.072843	1.904194	40.48511	0.58759
2408	61.48594	16263.88	4957.291	4.957291	1.950424	3.101113	3101.113	18.75704	22.9843	10.47961	44.23736	0.178533	9.66882	6.048485	1.598552	20.28754	0.364014
2410	91.20482	10964.33	3341.969	3.341969	2.160254	1.708594	1708.594	6.306417	15.73982	11.53554	16.69019	0.323062	7.219503	3.690998	1.955976	29.62339	0.714331
2412	86.78715	11522.44	3512.083	3.512083	2.123316	1.855244	1855.244	7.30831	16.47048	11.59828	19.09991	0.306476	7.457265	3.939271	1.893057	33.63051	0.867429
2414	65.1004	15360.89	4682.056	4.682056	2.609888	2.863841	2863.841	21.40522	28.7441	14.47395	51.44549	0.20111	12.21964	7.474306	1.634887	9.838429	0.812059
2416	73.93574	13525.26	4122.549	4.122549	2.298832	2.381508	2381.508	13.038	21.72904	13.03704	32.59477	0.249573	9.477046	5.474685	1.731067	16.91235	0.624981
2418	74.48306	13425.87	4092.255	4.092255	2.576587	2.355392	2355.392	14.29458	24.13716	14.60744	35.81381	0.252298	10.54405	6.068873	1.737398	21.21514	0.605389
2420	61.48594	16263.88	4957.291	4.957291	2.646615	3.101113	3101.113	25.45223	31.18839	14.22023	60.02759	0.178533	13.12004	8.207452	1.598552	3.854036	0.729513
2422	81.56627	12259.97	3736.884	3.736884	2.488085	2.049038	2049.038	10.44637	20.85071	13.88646	26.85436	0.285037	9.297687	5.098182	1.823726	25.75888	0.847877
2424	81.19664	12315.78	3753.895	3.753895	2.337425	2.063703	2063.703	9.95479	19.6985	13.06197	25.55891	0.283437	8.77445	4.823751	1.81901	24.8008	0.705048
2426	75.14056	13308.39	4056.447	4.056447	1.935076	2.324523	2324.523	10.45601	17.93473	10.96406	26.26402	0.255532	7.849534	4.49813	1.745066	32.21116	0.725896
2428	90.80321	11012.83	3356.75	3.35675	2.310594	1.721336	1721.336	6.846289	16.92969	12.36549	18.09513	0.321609	7.756088	3.97731	1.950084	21.69323	0.369277
2430	49.03614	20393.12	6215.899	6.215899	2.636408	4.18612	4186.12	46.19935	40.4188	9.619237	100.3603	0.08502	16.38765	11.03632	1.484883	17.39044	0.628719
2432	78.75502	12697.6	3870.277	3.870277	1.961357	2.164031	2164.031	9.185097	17.16306	11.03967	23.38387	0.27258	7.590993	4.244438	1.788457	29.27908	0.71237
2434	88.00063	11363.56	3463.654	3.463654	2.493536	1.813495	1813.495	8.200647	19.00783	13.54073	21.50873	0.311167	8.636745	4.522014	1.909933	32.68924	0.690842
2436	81.56627	12259.97	3736.884	3.736884	2.531919	2.049038	2049.038	10.63041	21.21804	14.1311	27.32746	0.285037	9.461487	5.187998	1.823726	16.91235	0.600036
2438	85.58233	11684.66	3561.526	3.561526	2.17153	1.897867	1897.867	7.821636	17.14193	11.92751	20.36715	0.301714	7.733961	4.121276	1.876594	34.60159	0.685684
2440	86.38554	11576.01	3528.411	3.528411	1.957774	1.86932	1869.32	6.841162	15.27493	10.71415	17.85754	0.304901	6.907832	3.659706	1.887537	34.60159	0.692028
2442	67.91165	14725.01	4488.239	4.488239	1.979771	2.696758	2696.758	14.39789	20.73189	11.1333	35.07423	0.217502	8.885687	5.338964	1.664309	15.42613	0.416105
2444	88.39357	11313.04	3448.256	3.448256	2.015325	1.800221	1800.221	6.531256	15.27659	10.92242	17.14974	0.312664	6.949356	3.62803	1.915463	30.77689	0.568509
2446	63.49396	15749.53	4800.514	4.800514	2.695383	2.96596	2965.96	23.71107	30.5792	14.77182	56.52373	0.191293	12.93922	7.994399	1.618536	36.2749	0.425113
2448	65.90361	15173.67	4624.992	4.624992	1.913795	2.814648	2814.648	15.16156	20.77227	10.66456	36.58389	0.205893	8.851289	5.386661	1.643186	20.54161	0.534264
2450	82.77108	12081.51	3682.49	3.68249	2.556517	2.002147	2002.147	10.24803	21.03836	14.20634	26.44948	0.290173	9.414348	5.118522	1.839271	40.80916	0.841527
2452	96.79452	10331.16	3148.977	3.148977	2.582804	1.542221	1542.221	6.143061	17.44095	13.34558	16.49281	0.342228	6.133186	3.983255	2.041845	41.66677	0.9035
2454	92.02325	10866.82	3312.247	3.312247	2.251191	1.682971	1682.971	6.376256	16.21735	11.96651	16.91227	0.32599	7.4565	3.78869	1.968095	29.79943	0.82456
2456	81.97081	12199.46	3718.442	3.718442	2.578856	2.03314	2033.14	10.6601	21.47941	14.37267	27.44075	0.286774	9.589325	5.243174	1.828916	24.08367	0.751313
2458	86.77528	11524.02	3512.564	3.512564	2.648437	1.855658	1855.658	9.119809	20.54735	14.46748	23.83333	0.30643	9.302804	4.914595	1.892894	17.86853	0.662087

2460	63.09237	15849.78	4831.071	4.831071	2.49912	2.992302	2992.302	22.3768	28.56642	13.64855	53.23128	0.188785	12.07343	7.478123	1.6145	31.25498	0.748578
2462	70.32129	14220.45	4334.444	4.334444	1.979919	2.564176	2564.176	13.01796	19.88365	11.205	32.05775	0.230807	8.581847	5.07686	1.690385	33.88446	0.698234
2464	72.32932	13825.65	4214.11	4.21411	2.264518	2.46044	2460.44	13.70886	21.98217	12.84293	34.04861	0.241402	9.54293	5.571711	1.712747	14.28287	0.694316
2466	56.66667	17647.06	5378.889	5.378889	1.984903	3.464559	3464.559	23.82514	25.74068	9.857254	54.62277	0.145491	10.67658	6.876816	1.552546	42.49004	0.283573
2468	82.77108	12081.51	3682.49	3.68249	2.440142	2.002147	2002.147	9.781534	20.08068	13.55966	25.24548	0.290173	8.985801	4.885523	1.839271	22.88845	0.880919
2470	86.78715	11522.44	3512.083	3.512083	2.035582	1.855244	1855.244	7.006335	15.78993	11.11904	18.31072	0.306476	7.149135	3.776502	1.893057	33.64872	0.797381
2472	79.45618	12585.55	3836.124	3.836124	2.566239	2.134589	2134.589	11.69299	22.21269	14.41736	29.84251	0.27575	9.84441	5.477866	1.797125	26.71315	0.743772
2474	87.99197	11364.67	3463.995	3.463995	2.23468	1.813788	1813.788	7.351713	17.03672	12.13558	19.26166	0.311134	7.740918	4.053236	1.909812	33.16733	0.871275
2476	75.94378	13167.64	4013.544	4.013544	2.175996	2.287538	2287.538	11.38662	19.90791	12.31683	28.68997	0.259426	8.733454	4.977673	1.754526	23.12749	0.712424
2478	88.79518	11261.87	3432.66	3.43266	2.591231	1.786776	1786.776	8.272685	19.53021	14.01509	21.74743	0.314182	8.894816	4.62995	1.921147	36.03586	0.940049
2480	88.74585	11268.13	3434.568	3.434568	2.5592	1.788421	1788.421	8.185474	19.30231	13.84533	21.51513	0.313996	8.789748	4.576928	1.920447	36.71604	0.839351
2482	85.18072	11739.75	3578.318	3.578318	2.524891	1.912343	1912.343	9.233666	20.04883	13.89305	24.01433	0.300102	9.034862	4.828457	1.871169	27.90837	0.989744
2484	75.54217	13237.64	4034.882	4.034882	2.280547	2.305932	2305.932	12.12641	20.9998	12.91552	30.50708	0.257487	9.201737	5.258787	1.749783	26.4741	0.190542
2486	110.4819	9051.254	2758.856	2.758856	2.238073	1.20591	1205.91	3.254649	12.70593	10.53616	6.995845	0.381906	6.17452	2.698915	2.287779	26.23506	0.46262
2488	81.94959	12202.62	3719.405	3.719405	2.390691	2.03397	2033.97	9.890368	19.91857	13.32499	25.45754	0.286684	8.891949	4.862594	1.828643	23.61418	0.372609
2490	90.48654	11051.37	3368.498	3.368498	2.343218	1.731464	1731.464	7.02489	17.24488	12.56161	18.55513	0.320455	7.893126	4.057198	1.945463	34.60159	0.178903
2492	92.00803	10868.62	3312.795	3.312795	2.532561	1.683444	1683.444	7.177232	18.24814	13.46332	19.03599	0.325936	8.389853	4.263423	1.967868	35.07968	0.926949
2494	89.84796	11129.91	3392.439	3.392439	2.570589	1.752102	1752.102	7.891354	19.08848	13.82758	20.80682	0.31811	8.720565	4.503934	1.93621	23.57094	0.594741
2496	105.261	9500.191	2895.693	2.895693	2.370505	1.323874	1323.874	4.154645	14.3511	11.58134	11.36702	0.367873	6.864256	3.138249	2.187288	33.64542	0.472586
2498	116.9076	8553.762	2607.218	2.607218	2.447708	1.075188	1075.188	2.829623	12.87511	10.9887	7.909438	0.397543	6.38171	2.631747	2.424895	33.88446	0.564656
2500	84.37751	11851.5	3612.381	3.612381	2.482452	1.941708	1941.708	9.359414	19.94624	13.70663	24.28051	0.296842	8.967564	4.820197	1.860414	28.91396	0.483923
2502	113.2932	8826.657	2690.398	2.690398	2.376446	1.146895	1146.895	3.1259	13.04384	10.95991	8.684004	0.388959	6.393585	2.725533	2.345811	28.38645	0.42551
2504	79.15663	12633.18	3850.64	3.85064	2.492789	2.147104	2147.104	11.4919	21.67744	14.01616	29.29836	0.274401	9.598836	5.352278	1.793411	29.34263	0.724174
2506	82.78228	12079.88	3681.992	3.681992	2.574498	2.001717	2001.717	10.31568	21.18278	14.30565	26.62506	0.29022	9.479281	5.153417	1.839417	28.38645	0.968494
2508	85.58233	11684.66	3561.526	3.561526	2.234671	1.897867	1897.867	8.049064	17.64036	12.27432	20.95937	0.301714	7.958841	4.24111	1.876594	29.22252	0.757991
2510	81.96787	12199.9	3718.575	3.718575	2.594679	2.033255	2033.255	10.72672	21.61216	14.46101	27.61197	0.286762	9.648509	5.275643	1.828878	33.88446	0.848028
2512	80.36145	12443.78	3792.91	3.79291	2.542671	2.097336	2097.336	11.18475	21.70357	14.24707	28.63526	0.27978	9.644122	5.332836	1.808442	31.59344	0.927405
2514	79.95984	12506.28	3811.96	3.81196	2.638519	2.113759	2113.759	11.78884	22.66127	14.80204	30.14003	0.278001	10.05793	5.577192	1.803404	26.15998	0.871259
2516	67.20836	14879.1	4535.205	4.535205	2.740315	2.737246	2737.246	20.53185	29.05567	15.36777	49.8529	0.213492	12.42789	7.500916	1.65685	31.73307	0.559848
2518	81.16466	12320.63	3755.375	3.755375	2.609261	2.064978	2064.978	11.12624	22.00009	14.58259	28.56352	0.283298	9.798752	5.388067	1.818603	33.91527	0.960056
2520	81.15055	12322.78	3756.028	3.756028	2.64272	2.065541	2065.541	11.27506	22.28698	14.77028	28.94418	0.283237	9.926127	5.458645	1.818423	38.90438	0.97189
2522	79.95984	12506.28	3811.96	3.81196	2.545535	2.113759	2113.759	11.37339	21.86267	14.28041	29.07787	0.278001	9.703479	5.380647	1.803404	36.71806	0.966539
2524	78.35341	12762.69	3890.114	3.890114	2.716076	2.181133	2181.133	12.9213	23.91702	15.30282	32.84839	0.270745	10.56585	5.924123	1.783529	34.84064	0.918148
2526	73.53414	13599.13	4145.064	4.145064	2.741268	2.400917	2400.917	15.80178	26.08289	15.54837	39.44058	0.247555	11.36273	6.581558	1.72645	36.994	0.972056
2528	81.17481	12319.09	3754.905	3.754905	2.33875	2.064573	2064.573	9.968835	19.71621	13.07032	25.59308	0.283342	8.781784	4.828521	1.818732	21.45027	0.836153
2530	76.74699	13029.83	3971.54	3.97154	2.529422	2.251327	2251.327	12.82031	22.84588	14.29901	32.40029	0.263258	10.0457	5.694556	1.764088	24.18453	0.715057
2532	82.77108	12081.51	3682.49	3.68249	2.57483	2.002147	2002.147	10.32144	21.18907	14.30811	26.63894	0.290173	9.481786	5.155187	1.839271	29.49629	0.860974
2534	86.38554	11576.01	3528.411	3.528411	2.629571	1.86932	1869.32	9.18866	20.51641	14.39064	23.98523	0.304901	9.278208	4.91551	1.887537	32.99931	0.967381
2536	89.19679	11211.17	3417.205	3.417205	2.473823	1.773453	1773.453	7.780506	18.53948	13.35248	20.47698	0.315689	8.453562	4.387208	1.926866	33.64542	0.834208
2538	81.16466	12320.63	3755.375	3.755375	2.471857	2.064978	2064.978	10.54033	20.84156	13.81467	27.05936	0.283298	9.282748	5.10433	1.818603	36.2749	0.967377
2540	79.11801	12639.35	3852.52	3.85252	2.646906	2.148724	2148.724	12.2208	23.03147	14.88426	31.15244	0.274227	10.19726	5.68747	1.792934	25.03984	0.820764
2542	78.35341	12762.69	3890.114	3.890114	2.557216	2.181133	2181.133	12.16555	22.51814	14.40778	30.92712	0.270745	9.947862	5.577628	1.783529	28.86454	0.889023
2544	76.74699	13029.83	3971.54	3.97154	2.383085	2.251327	2251.327	12.0786	21.52415	13.47175	30.52581	0.263258	9.464515	5.365103	1.764088	22.88845	0.834886
2546	76.34538	13098.37	3992.432	3.992432	2.255283	2.269338	2269.338	11.61447	20.50086	12.75789	29.30861	0.26135	9.004063	5.117998	1.759294	30.05976	0.755834
2548	85.04695	11758.21	3583.946	3.583946	2.211859	1.917195	1917.195	8.129991	17.59771	12.17772	21.13521	0.299562	7.927184	4.240565	1.86937	25.03984	0.976966
2550	85.99068	11629.17	3544.613	3.544613	2.622587	1.883287	1883.287	9.301717	20.57965	14.3785	24.25139	0.30334	9.296058	4.939085	1.882142	34.21436	0.982306
2552	81.56627	12259.97	3736.884	3.736884	2.558388	2.049038	2049.038	10.74154	21.43987	14.27884	27.61316	0.285037	9.560402	5.242236	1.823726	27.48086	0.96642
2554	83.22175	12016.09	3662.549	3.662549	2.863122	1.984956	1984.956	11.28084	23.40315	15.88259	29.15764	0.292065	10.48632	5.683169	1.845154	33.40637	0.909705
2556	87.18876	11469.37	3495.906	3.495906	2.643363	1.841298	1841.298	8.962005	20.38602	14.41135	23.44973	0.308041	9.240949	4.86722	1.898609	38.18725	0.858204
2558	77.72691	12865.56	3921.47	3.92147	2.630762	2.208163	2208.163	12.82756	23.39501	14.8433	32.53612	0.267853	10.31645	5.809153	1.775896	21.93996	0.978371
2560	82.38228	12138.53	3699.87	3.69987	2.485401	2.017129	2017.129	10.11263	20.57296	13.83121	26.06683	0.288528	9.195661	5.013375	1.834226	35.07958	0.970142
2562	78.05132	12812.08	3905.171	3.905171	2.574457	2.194113	2194.113	12.39377	22.77768	14.51516	31.47297	0.269355	10.05369	5.648649	1.779841	28.38645	0.906121
2564	75.67058	13215.18	4028.035	4.028035	2.413419	2.30003	2300.03	12.76732	22.17734	13.66579	32.13527	0.258108	9.721333	5.550935	1.751297	29.10359	0.729513
2566	80.09224	12485.6	3805.659	3.805659	2.551234	2.108326	2108.326	11.34034	21.86697	14.30675	29.00667	0.278589	9.709127	5.378835	1.805061	28.65239	0.893709
2568	76.43123	13083.66	3987.947	3.987947	2.641269	2.265472	2265.472	13.55595	23.9766	14.9393	34.21892	0.261759	10.53324	5.983721	1.760316	29.10359	0.958777
2570	78.43817	12748.9	3885.911	3.885911	2.516926	2.177509	2177.509	11.93412	22.13396	14.17788	30.34804	0.271133	9.780548	5.480629	1.784567	23.12749	0.962778

2572	80.97889	12348.9	3763.99	3.76399	2.54272	2.072405	2072.405	10.92063	21.49985	14.21942	28.01806	0.282489	9.570772	5.269545	1.816242	29.31631	0.896238
2574	78.99688	12658.73	3858.427	3.858427	2.430163	2.153817	2153.817	11.27335	21.1854	13.66984	28.72493	0.273679	9.376606	5.234125	1.791437	19.22573	0.611407
2576	75.14056	13308.39	4056.447	4.056447	2.412216	2.324523	2324.523	13.03419	22.35697	13.66751	32.74004	0.255532	9.785026	5.607252	1.745066	22.88845	0.826989
2578	79.55823	12569.41	3831.203	3.831203	2.550933	2.130347	2130.347	11.5771	22.04534	14.32728	29.5573	0.276208	9.773142	5.434373	1.798394	25.03984	0.922435
2580	80.01096	12498.29	3809.524	3.809524	2.634434	2.111659	2111.659	11.74721	22.60836	14.77689	30.03894	0.278228	10.03594	5.563026	1.804043	21.98693	0.983996
2582	83.17269	12023.18	3664.709	3.664709	2.351563	1.986818	1986.818	9.282667	19.23576	13.04731	23.98916	0.291859	8.617793	4.672127	1.844512	27.62281	0.997864
2584	79.15663	12633.18	3850.64	3.85064	2.447196	2.147104	2147.104	11.28171	21.28096	13.75982	28.76249	0.274401	9.423272	5.254384	1.793411	27.19124	0.780665
2586	78.32423	12767.44	3891.563	3.891563	2.480369	2.182382	2182.382	11.81348	21.85143	13.97578	30.02895	0.270611	9.652512	5.413113	1.783172	22.546	0.77045
2588	79.95984	12506.28	3811.96	3.81196	2.624695	2.113759	2113.759	11.72707	22.54254	14.72449	29.98212	0.278001	10.00523	5.547972	1.803404	30.75115	0.49402
2590	84.37751	11851.5	3612.381	3.612381	2.642161	1.941708	1941.708	9.961551	21.22948	14.58844	25.8426	0.296842	9.544492	5.130304	1.860414	23.60558	0.850835
2592	85.57304	11685.92	3561.913	3.561913	2.604018	1.898201	1898.201	9.382708	20.55875	14.30361	24.43141	0.301676	9.275284	4.942948	1.876468	34.01443	0.857247
2594	85.28576	11725.29	3573.911	3.573911	2.475292	1.908544	1908.544	9.016349	19.62476	13.61386	23.45674	0.300525	8.846472	4.724203	1.872585	30.58323	0.679476
2596	79.55823	12569.41	3831.203	3.831203	2.523387	2.130347	2130.347	11.45208	21.80728	14.17256	29.23812	0.276208	9.667606	5.37569	1.798394	19.06375	0.596593
2598	82.88594	12064.77	3677.387	3.677387	2.448926	1.997748	1997.748	9.773655	20.1183	13.60253	25.23457	0.290657	9.00565	4.892337	1.840767	25.27888	0.671663
2600	71.92771	13902.85	4237.639	4.237639	2.468532	2.480724	2480.724	15.19132	24.12442	13.99688	37.66747	0.239317	10.46075	6.123745	1.708227	26.71947	0.600747
2602	83.35615	11996.72	3656.643	3.656643	2.548801	1.979865	1979.865	9.990955	20.79215	14.13151	25.83485	0.292626	9.320055	5.046281	1.846916	30.77689	0.91373
2604	78.63888	12716.36	3875.993	3.875993	2.559856	2.168959	2168.959	12.04255	22.44095	14.41259	30.6458	0.272051	9.921984	5.552224	1.787029	19.54183	0.780005
2606	79.08211	12645.09	3854.269	3.854269	2.622975	2.150232	2150.232	12.12732	22.83598	14.7511	30.91021	0.274064	10.10965	5.640004	1.79249	29.34938	0.771283
2608	80.29311	12454.37	3796.138	3.796138	2.601287	2.100119	2100.119	11.47298	22.22722	14.57857	29.36628	0.279479	9.874846	5.463013	1.807582	31.73307	0.845889
2610	81.23369	12310.16	3752.183	3.752183	2.615523	2.062227	2062.227	11.12324	22.02971	14.61422	28.56247	0.283598	9.81392	5.393801	1.819481	27.43028	0.916874
2612	82.95353	12054.94	3674.391	3.674391	2.64179	1.995165	1995.165	10.51613	21.68075	14.67	27.15751	0.290941	9.706969	5.270806	1.841648	31.23497	0.971202
2614	83.1717	12023.32	3664.753	3.664753	2.643836	1.986856	1986.856	10.4368	21.62687	14.66901	26.97169	0.291855	9.689007	5.252922	1.844499	34.60159	0.969793
2616	78.53475	12733.22	3881.132	3.881132	2.590457	2.173389	2173.389	12.23634	22.7462	14.58864	31.12735	0.271575	10.0539	5.630071	1.785751	22.18732	0.544663
2618	77.99263	12821.72	3908.109	3.908109	2.793982	2.196646	2196.646	13.48167	24.74275	15.75497	34.2283	0.269084	10.91918	6.137388	1.779126	27.43028	0.929057
2620	67.12585	14897.39	4540.78	4.54078	2.626389	2.742051	2742.051	19.74741	27.88861	14.72367	47.92956	0.213018	11.92585	7.201694	1.655979	28.38645	0.973997
2622	78.62966	12717.85	3876.447	3.876447	2.610007	2.169351	2169.351	12.28291	22.88389	14.69528	31.25643	0.272009	10.11755	5.66202	1.786916	28.23106	0.869776
2624	81.7748	12228.71	3727.355	3.727355	2.647572	2.040823	2040.823	11.02703	22.11723	14.76588	28.36679	0.285934	9.868441	5.403227	1.826398	27.19803	0.973042
2626	80.87317	12365.04	3768.91	3.76891	2.626604	2.076647	2076.647	11.32713	22.245	14.69358	29.05055	0.282028	9.899434	5.454528	1.814902	29.34263	0.97031
2628	81.16466	12320.63	3755.375	3.755375	2.590709	2.064978	2064.978	11.04713	21.84366	14.47891	28.36043	0.283298	9.729082	5.349757	1.818603	29.58167	0.970601
2630	83.62249	11958.51	3644.997	3.644997	2.643153	1.969825	1969.825	10.25599	21.47647	14.63915	26.54283	0.293733	9.634285	5.206549	1.850417	26.96921	0.981354
2632	86.38554	11576.01	3528.411	3.528411	2.626423	1.86932	1869.32	9.17766	20.49185	14.37341	23.95652	0.304901	9.2671	4.909625	1.887537	18.8247	0.76053
2634	84.37751	11851.5	3612.381	3.612381	2.6454	1.941708	1941.708	9.973763	21.2555	14.60633	25.87428	0.296842	9.556192	5.136593	1.860414	31.01594	0.970959
2636	76.77449	12694.46	3869.32	3.86932	2.716391	2.163207	2163.207	12.71125	23.76285	15.28868	32.36317	0.272669	10.51058	5.876115	1.788696	31.01594	0.971919
2638	82.1193	12177.41	3711.718	3.711718	2.641948	2.027343	2027.343	10.85873	21.95562	14.71647	27.96578	0.287409	9.806167	5.356136	1.830829	26.95219	0.977263
2640	79.71582	12544.56	3823.629	3.823629	2.63088	2.123818	2123.818	11.86685	22.68091	14.76968	30.31375	0.276913	10.05951	5.587511	1.800356	30.74413	0.862709
2642	86.01216	11626.26	3543.728	3.543728	2.657982	1.882524	1882.524	9.419616	20.85088	14.57113	24.56037	0.303425	9.419167	5.003716	1.882434	31.97211	0.976003
2644	80.34171	12446.84	3793.841	3.793841	2.687165	2.098139	2098.139	11.82941	22.94389	15.05761	30.28367	0.279693	10.19468	5.638047	1.808193	41.53386	0.8548
2646	96.82731	10327.66	3147.911	3.147911	2.391315	1.541302	1541.302	5.680838	16.14084	12.35362	15.25306	0.342335	7.527646	3.685739	2.042371	35.31873	0.865949
2648	85.18072	11739.75	3578.318	3.578318	2.6417	1.912343	1912.343	9.660845	20.97635	14.53579	25.12531	0.300102	9.452843	5.051837	1.871169	30.77689	0.985639
2650	86.38554	11576.01	3528.411	3.528411	2.61654	1.86932	1869.32	9.143126	20.41475	14.31933	23.86638	0.304901	9.23223	4.891151	1.887537	31.97211	0.985639
2652	71.5261	13980.91	4261.433	4.261433	2.678279	2.501235	2501.235	16.75579	26.35184	15.18131	41.47646	0.237216	11.41331	6.699007	1.703731	19.74257	0.985639
2654	70.72289	14139.69	4309.831	4.309831	2.671485	2.542958	2542.958	17.27552	26.64545	15.12844	42.61646	0.23296	11.51365	6.793474	1.69481	23.32222	0.923736
2656	83.5743	11965.4	3647.099	3.647099	2.610699	1.971637	1971.637	10.1487	21.22799	14.46218	26.26113	0.293533	9.521476	5.14735	1.849782	30.53785	0.874908
2658	92.00803	10868.62	3312.795	3.312795	2.504022	1.683444	1683.444	7.096353	18.04251	13.3116	18.82148	0.325936	8.295309	4.215379	1.967868	38.42629	0.976492
2660	78.8822	12677.13	3864.037	3.864037	2.648759	2.158652	2158.652	12.34263	23.13233	14.90391	31.43671	0.273158	10.2349	5.71775	1.790023	25.22996	0.882308
2662	86.01794	11625.48	3543.49	3.54349	2.618578	1.882319	1882.319	9.277947	20.54003	14.35473	24.19141	0.303448	9.278903	4.928998	1.882513	32.31695	0.811887
2664	83.5743	11965.4	3647.099	3.647099	2.594591	1.971637	1971.637	10.08609	21.09701	14.37295	26.0991	0.293533	9.46273	5.115591	1.849782	27.43028	0.970496
2666	61.73459	16198.37	4937.324	4.937324	2.724286	3.0839	3083.9	25.90916	31.9512	14.67843	61.18832	0.180143	13.45068	8.401426	1.601	27.01156	0.8163
2668	83.5743	11965.4	3647.099	3.647099	2.635835	1.971637	1971.637	10.24642	21.43237	14.60143	26.51397	0.293533	9.613149	5.196909	1.849782	28.14741	0.985542
2670	76.80024	13020.79	3968.786	3.968786	2.672231	2.248953	2248.953	13.51555	24.11528	15.10489	34.16423	0.26351	10.60551	6.009724	1.764726	30.0253	0.990679
2672	79.15663	12633.18	3850.64	3.85064	2.889657	2.147104	2147.104	13.32148	25.12863	16.24764	33.96284	0.274401	11.12703	6.204394	1.793411	25.03984	0.493931
2674	72.32932	13825.65	4214.11	4.21411	2.664206	2.46044	2460.44	16.12848	25.86203	15.10971	40.05819	0.241402	11.22726	6.555119	1.712747	26.56566	0.350446
2676	89.59839	11160.91	3401.888	3.401888	2.508139	1.760248	1760.248	7.771404	18.69033	13.50939	20.47622	0.317186	8.532408	4.414947	1.932618	22.6494	0.558785
2678	101.3492	9866.875	3007.46	3.00746	2.274578	1.420224	1420.224	4.587907	14.47122	11.41262	12.44821	0.356495	6.840701	3.23041	2.117595	26.5847	0.094268
2680	85.22142	11734.14	3576.609	3.576609	2.383541	1.91087	1910.87	8.703318	18.91516	13.11295	22.63788	0.300266	8.524993	4.554636	1.871718	22.87832	0.303246
2682	88.79518	11261.87	3432.66	3.43266	2.36991	1.786776	1786.776	7.566101	17.86711	12.81804	19.88995	0.314182	8.135096	4.234498	1.921147	21.67313	0.580378

2684	79.55823	12569.41	3831.203	3.831203	2.583385	2.130347	2130.347	11.72438	22.32579	14.50954	29.93332	0.276208	9.897471	5.503507	1.798394	27.66932	0.4886
2686	79.15663	12633.18	3850.64	3.85064	2.574561	2.147104	2147.104	11.86887	22.38853	14.47595	30.25944	0.274401	9.913707	5.527849	1.793411	29.82072	0.919974
2688	76.7493	13029.43	3971.42	3.97142	2.556814	2.251224	2251.224	12.95796	23.09243	14.4538	32.74844	0.263269	10.15418	5.75596	1.764116	26.4741	0.613362
2690	79.28581	12612.6	3844.367	3.844367	2.602329	2.141695	2141.695	11.93652	22.58466	14.62698	30.44578	0.274984	10.00431	5.573396	1.795011	28.14741	0.47774
2692	79.55207	12570.38	3831.499	3.831499	2.56439	2.130603	2130.603	11.64097	22.16375	14.40311	29.71972	0.276181	9.825459	5.463697	1.798317	33.6879	0.961465
2694	70.96854	14090.75	4294.913	4.294913	2.594658	2.530097	2530.097	16.60942	25.77124	14.69829	41.01661	0.234269	11.14383	6.564736	1.697529	21.59622	0.517684
2696	76.39522	13089.82	3989.827	3.989827	2.577683	2.267092	2267.092	13.24853	23.41285	14.5805	33.43838	0.261587	10.28451	5.843844	1.759887	23.82213	0.785245
2698	76.19373	13124.44	4000.378	4.000378	2.539219	2.276188	2276.188	13.15577	23.138	14.36749	33.17902	0.260625	10.15784	5.779739	1.75749	25.27888	0.488511
2700	75.857	13182.7	4018.136	4.018136	2.597338	2.291496	2291.496	13.6385	23.79588	14.70355	34.35252	0.259008	10.43646	5.95179	1.753499	27.70022	0.647363
2702	73.13253	13673.81	4167.827	4.167827	2.62003	2.42054	2420.54	15.3508	25.09541	14.86154	38.25269	0.245521	10.91983	6.341888	1.721858	24.89699	0.765268
2704	77.14859	12962	3950.865	3.950865	2.590778	2.233505	2233.505	12.92421	23.25113	14.635	32.71167	0.265152	10.23582	5.786515	1.768909	27.97831	0.745216
2706	76.34538	13098.37	3992.432	3.992432	2.591916	2.269338	2269.338	13.34809	23.56091	14.66219	33.68334	0.26135	10.34805	5.881933	1.759294	28.86454	0.923478
2708	82.77108	12081.51	3682.49	3.68249	2.586655	2.002147	2002.147	10.36884	21.28638	14.37382	26.76128	0.290173	9.525331	5.178862	1.839271	31.01594	0.878722
2710	64.6988	15456.24	4711.119	4.711119	2.744385	2.888895	2888.895	22.90386	30.4485	15.17926	54.93679	0.198687	12.92912	7.928241	1.630768	28.14741	0.192443
2712	73.13253	13673.81	4167.827	4.167827	2.651971	2.42054	2420.54	15.53794	25.40135	15.04272	38.71904	0.245521	11.05296	6.419203	1.721858	22.82593	0.52236
2714	81.56627	12259.97	3736.884	3.736884	2.671541	2.049038	2049.038	11.21662	22.38811	14.91036	28.83443	0.285037	9.983239	5.47409	1.823726	31.19501	0.805592
2716	72.73092	13749.31	4190.841	4.190841	2.594821	2.44038	2440.38	15.45334	25.02028	14.71806	38.44504	0.24347	10.87448	6.332349	1.71729	19.30279	0.69074
2718	65.90361	15173.67	4624.992	4.624992	2.583612	2.814648	2814.648	20.46801	28.04244	14.3971	49.38803	0.205893	11.94919	7.271961	1.643186	18.58566	0.592997
2720	79.15663	12633.18	3850.64	3.85064	2.393569	2.147104	2147.104	11.03448	20.81462	13.45829	28.1322	0.274401	9.216774	5.139241	1.793411	20.1563	0.318539
2722	69.51807	14384.75	4384.525	4.384525	2.438624	2.607349	2607.349	16.57842	24.83094	13.77867	40.68155	0.226445	10.69221	6.358342	1.681603	16.64618	0.083664
2724	70.72289	14139.69	4309.831	4.309831	2.431045	2.542958	2542.958	15.72068	24.24729	13.76684	38.78087	0.23296	10.47739	6.182045	1.69481	9.400407	0.018956
2726	70.77024	14130.23	4306.947	4.306947	2.420471	2.540472	2540.472	15.62171	24.12236	13.70789	38.5446	0.233213	10.42484	6.149138	1.695334	10.69721	0.113296
2728	73.168	13667.18	4165.806	4.165806	2.444292	2.418798	2418.798	14.30054	23.39838	13.86469	35.6407	0.245701	10.18245	5.912249	1.722263	10.45817	0.108286
2730	79.55823	12569.41	3831.203	3.831203	2.381601	2.130347	2130.347	10.80861	20.58196	13.37623	27.59528	0.276208	9.124397	5.073637	1.798394	17.62948	0.302441
2732	80.01912	12497.01	3809.136	3.809136	2.412824	2.111324	2111.324	10.75562	20.70393	13.53352	27.50409	0.278265	9.190774	5.094253	1.804146	14.52191	0.689341
2734	86.38479	11576.11	3528.442	3.528442	2.344312	1.869346	1869.346	8.192094	18.29097	12.82957	21.38384	0.304898	8.271769	4.382331	1.887527	26.4741	0.614542
2736	80.30929	12451.86	3795.373	3.795373	2.387065	2.09946	2099.46	10.52154	20.39168	13.37732	26.93248	0.27955	9.059802	5.011546	1.807786	26.23506	0.823701
2738	84.67952	11809.23	3599.497	3.599497	2.342191	1.930601	1930.601	8.729865	18.73561	12.9157	22.66876	0.298074	8.430712	4.521838	1.864444	26.71315	0.969368
2740	70.72289	14139.69	4309.831	4.309831	2.563922	2.542958	2542.958	16.57994	25.57261	14.51931	40.90057	0.23296	11.05007	6.519945	1.69481	24.8552	0.645552
2742	72.73092	13749.31	4190.841	4.190841	2.528565	2.44038	2440.38	15.05875	24.38141	14.34224	37.46338	0.24347	10.59681	6.170658	1.71729	19.54183	0.975007
2744	73.53414	13599.13	4145.064	4.145064	2.530423	2.400917	2400.917	14.58638	24.07672	14.35246	36.407	0.247555	10.48876	6.075336	1.72645	20.33185	0.732534
2746	78.39776	12755.47	3887.913	3.887913	2.537042	2.179236	2179.236	12.04858	22.32498	14.29259	30.63467	0.270948	9.863799	5.528812	1.784072	24.51692	0.854036
2748	73.93574	13525.26	4122.549	4.122549	2.657053	2.381508	2381.508	15.06969	25.11502	15.06857	37.67394	0.249573	10.95383	6.327793	1.731067	18.29792	0.519507
2750	70.32129	14220.45	4334.444	4.334444	2.564394	2.564176	2564.176	16.86089	25.75333	14.51274	41.52125	0.230807	11.11522	6.575558	1.690385	16.2495	0.548719
2752	70.72289	14139.69	4309.831	4.309831	2.580372	2.542958	2542.958	16.68632	25.73668	14.61247	41.16298	0.23296	11.12097	6.561776	1.69481	23.68977	0.407007
2754	78.35341	12762.69	3890.114	3.890114	2.686299	2.181133	2181.133	12.77964	23.65481	15.13505	32.48826	0.270745	10.45001	5.859174	1.783529	25.32173	0.981403
2756	78.32496	12767.32	3891.527	3.891527	2.526693	2.182351	2182.351	12.03377	22.25929	14.23677	30.58899	0.270614	9.832695	5.514131	1.783181	22.56774	0.942537
2758	75.14056	13308.39	4056.447	4.056447	2.527238	2.324523	2324.523	13.6557	23.42302	14.31922	34.30119	0.255532	10.25161	5.874623	1.745066	20.32657	0.916381
2760	77.60007	12886.59	3927.879	3.927879	2.594814	2.213689	2213.689	12.71568	23.12156	14.64444	32.23739	0.267263	10.19212	5.744112	1.774359	21.74614	0.734955
2762	75.89382	13176.3	4016.186	4.016186	2.587229	2.289816	2289.816	13.56551	23.68924	14.64557	34.17344	0.259185	10.39079	5.924278	1.753934	20.26185	0.827235
2764	77.17198	12958.07	3949.668	3.949668	2.525011	2.232473	2232.473	12.58449	22.6525	14.26284	31.85457	0.265262	9.972955	5.637017	1.76919	20.94377	0.944782
2766	75.54217	13237.64	4034.882	4.034882	2.577987	2.305932	2305.932	13.70799	23.73869	14.60003	34.48596	0.257487	10.40187	5.944663	1.749783	31.73307	0.949717
2768	77.14859	12962	3950.865	3.950865	2.507263	2.233505	2233.505	12.50759	22.50162	14.16323	31.65719	0.265152	9.905858	5.599983	1.768909	22.66132	0.845124
2770	79.19305	12627.37	3848.869	3.848869	2.562196	2.145577	2145.577	11.79507	22.2684	14.40502	30.07516	0.274566	9.861557	5.497389	1.793862	17.15139	0.718603
2772	70.72289	14139.69	4309.831	4.309831	2.558048	2.542958	2542.958	16.54196	25.51402	14.48605	40.80687	0.23296	11.02475	6.505008	1.69481	22.41036	0.947005
2774	72.84459	13727.86	4184.301	4.184301	2.56955	2.434742	2434.742	15.23222	24.7298	14.57499	37.91261	0.244052	10.75177	6.256192	1.718581	22.88845	0.831449
2776	75.14056	13308.39	4056.447	4.056447	2.527331	2.324523	2324.523	13.6562	23.42388	14.31975	34.30246	0.255532	10.25198	5.87484	1.745066	22.17131	0.948987
2778	77.13229	12964.74	3951.701	3.951701	2.598401	2.234225	2234.225	12.97059	23.32558	14.67852	32.82709	0.265075	10.2681	5.805411	1.768712	21.03537	0.767958
2780	77.14859	12962	3950.865	3.950865	2.559231	2.233505	2233.505	12.76683	22.96801	14.45679	32.31334	0.265152	10.11118	5.716054	1.768909	22.60771	0.897175
2782	79.15663	12633.18	3850.64	3.85064	2.554106	2.147104	2147.104	11.77457	22.21066	14.36094	30.01903	0.274401	9.834945	5.483931	1.793411	24.8008	0.885352
2784	80.36145	12443.78	3792.91	3.79291	2.645245	2.097336	2097.336	11.63595	22.57912	14.82181	29.79044	0.27978	10.03318	5.547968	1.808442	20.49801	0.962704
2786	81.16466	12320.63	3755.375	3.755375	2.582642	2.064978	2064.978	11.01274	21.77565	14.43383	28.27213	0.283298	9.69879	5.3331	1.818603	24.32271	0.76046
2788	81.51842	12267.17	3739.078	3.739078	2.572983	2.050929	2050.929	10.82276	21.57783	14.36265	27.81749	0.28483	9.620582	5.277005	1.823114	24.54576	0.893856
2790	71.1245	14059.85	4285.495	4.285495	2.622747	2.521979	2521.979	16.68166	25.98138	14.86027	41.22251	0.235097	11.23977	6.614513	1.699259	19.78088	0.809412
2792	84.16024	11882.1	3621.707	3.621707	2.531442	1.949747	1949.747	9.623313	20.40531	13.98977	24.94804	0.295952	9.168142	4.935672	1.857526	20.9761	0.898095
2794	83.17269	12023.18	3664.709	3.664709	2.5468	1.986818	1986.818	10.05336	20.83279	14.13056	25.98084	0.291859	9.33328	5.060028	1.844512	26.4741	0.814391