Petrophysical and geomechanical properties of rocks from the oilfields of the Krishna-Godavari and Cauvery Basins, India

Rima Chatterjee · Manoj Mukhopadhyay

Abstract The petrophysical and mechanical properties of reservoir rocks from two major basins on the east coast of India were studied using samples cored from 19 wells in the Krishna-Godavari and Cauvery basins. Several of these drill holes are located in the producing oilfields in these basins. The purpose of the study was to investigate the relationships between the properties of the rocks including dry density, effective porosity, uniaxial compressive strength, tensile strength and Young's modulus. Their relationships are further elucidated using regression analyses. The results indicated that the petrophysical and geomechanical properties vary widely for the different sedimentary rocks and basement samples related to their depth and geological age. It is emphasized that the work should be further extended to assess its full potential in reservoir studies of the oilfields in these basins.

Résumé Les propriétés pétrophysiques et mécaniques des roches réservoirs de deux bassins importants de la côte est de l'Inde ont été étudiées, utilisant des échantillons carottés à partir de 19 puits dans les bassins de Krishna-Godavari et Cauvery. Plusieurs de ces forages sont situés dans les champs pétrolifères en cours de production dans ces bassins. Le but de l'étude était de rechercher des relations entre propriétés de ces roches, telles que la densité sèche, la porosité efficace, la résistance à la compression simple, la résistance à la traction et le module de Young. Ces relations sont établies en prenant appui sur des analyses de régression. Les résultats ont montré que les propriétés pétrophy siques et mécaniques varient largement pour leséchantillons des différentes roches sédimentaires et du substratum, en fonction de leur profondeur et deleur âge géologique. Il est souligné que ce travail devrait être étendu pour établir son intérêt potentiel dans les études des roches réservoirs des champs pétrolifères de ces bassins.

Keywords Krishna-Godavari basin · Cauvery basin · Petrophysical properties · Mechanical properties

Mots clés Bassin de Krishna-Godavari · Bassin de Cauvery · Propriétés pétrophysiques · Propriétés mécaniques

Introduction

The strength and mechanical properties of a rock, together with its petrophysical properties, are important parameters when considering rock failure, the drilling of wells/ borings and the construction of reservoirs (Worthington 1991). The mechanical properties of a rock depend primarily on its mineral composition and constitution, i.e. its structural and textural features (Bell et al. 1999). The rock mass contains planes of weakness, making it mechanically anisotropic. The numerous factors that influence the strength and deformability of sedimentary rocks can be divided into two broad categories: the nature and condition of the rock itself (e.g. mineralogy, texture, porosity, density, in-situ stresses and moisture content) and factors related to sample preparation and testing methods.

The amount of cementing material can be important with respect to strength and deformability (Dyke and Dobereiner 1991). If the bonding material is silica, which may be as strong as the quartz grains forming the rock, the cement will considerably enhance the strength and stiffness of a sandstone. However, where the cement is weak, for example in a clay or carbonate, it is not a dominating factor influencing strength and deformability. A number of authors have discussed correlations between the petrographical and mechanical properties of common rocks

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such as granite, sandstone, limestone, shale, etc. (see, for example, Bell 1978; Sachpazis 1990; Ghafoori et al. 1993; Ulusay et al. 1994; Shakoor and Brown 1996; Topal and Doyuran 1997; Bell et al. 1999; Bell and Lindsay 1999; Tugrul and Zarif 1999).

The present study reports data on core samples collected from 19 wells in the Krishna-Godavari (K-G) and Cauvery basins, both onshore and offshore. Thin section studies and the measurement of dry density, effective porosity, uniaxial/unconfined compressive strength, tensile strength, Young's modulus and Poisson's ratio were undertaken and a bivariate regression analysis carried out in order to investigate the relationship between the petrophysical and mechanical properties of the rocks.

Sample collection

In all, 22 core samples of sedimentary and basement rocks were collected, varying in strength from relatively weak to hard and compact. The 12 samples from the K-G basin ranged in age from Permo-Triassic to Miocene, while the ten from the Cauvery basin (through the courtesey of Oil and Natural Gas Corporation, India) accumulated between the Cretaceous and the Tertiary. Figures 1 and 2 show the distribution of wells in the K-G and Cauvery basins together with the regional tectonic trend and the more obvious structures of the K-G and Cauvery basins as mapped by Oil and Natural Gas Corporation (Sastri et al. 1973, 1981).

A series of horst and graben structures dominate the K-G basin while an alignment of NE- to SW-trending elongated ridges and sub-basins dominates the Cauvery basin (Sastri et al. 1981; Prabhakar et al. 1995). The Vedaranniyam High is located to the east of the Nagapattinam sub-basin and is aligned N–S (Sastri et al. 1981).

The core samples collected from the major oil/gas fields in K-G basin were from depths of between 2,024 and 3,311 m:

- KGS-1 (well KG_3), KGS-7 and KGS-8 (well KG_{18}) near the Ravva oil field.
- KGS-3 (well KG_{13}), KGS-4 and KGS-5 (well KG_{14}) from the Mandapeta gasfield; KGS-11 (well KG_{21}) and KGS-12 (well KG_{22}) from the Razole gasfield.
- KGS-2 (KG_7) near the Razole field.
- KGS-6 (well KG_{17}) from the Bantumilli oil field.
- KGS-9 (well KG_{19}) from the Lingala oilfield.
- KGS-10 (well KG_{20}) from the Kaikalur oilfield.

For the Cauvery basin, the samples were from 2,268 to 4,370 m:

- CS-1(well C_2) was from the PYH oilfield.
- CS-4 (well C_6) in the Pondicherry sub-basin.
- CS-5 (well C_7) near the western flank of the Karaikal High.
- CS-6 (well C_8), CS-7 (well C_9) and CS-8 (well C_{10}).
- CS-9 (well C_{11}) from the oilfield of Nannilam High.
- CS-10 (well C_{12}) in the Ramnad-Palkbay sub-basin.
- CS-2 and CS-3 (well C_5) near the PH oilfield.

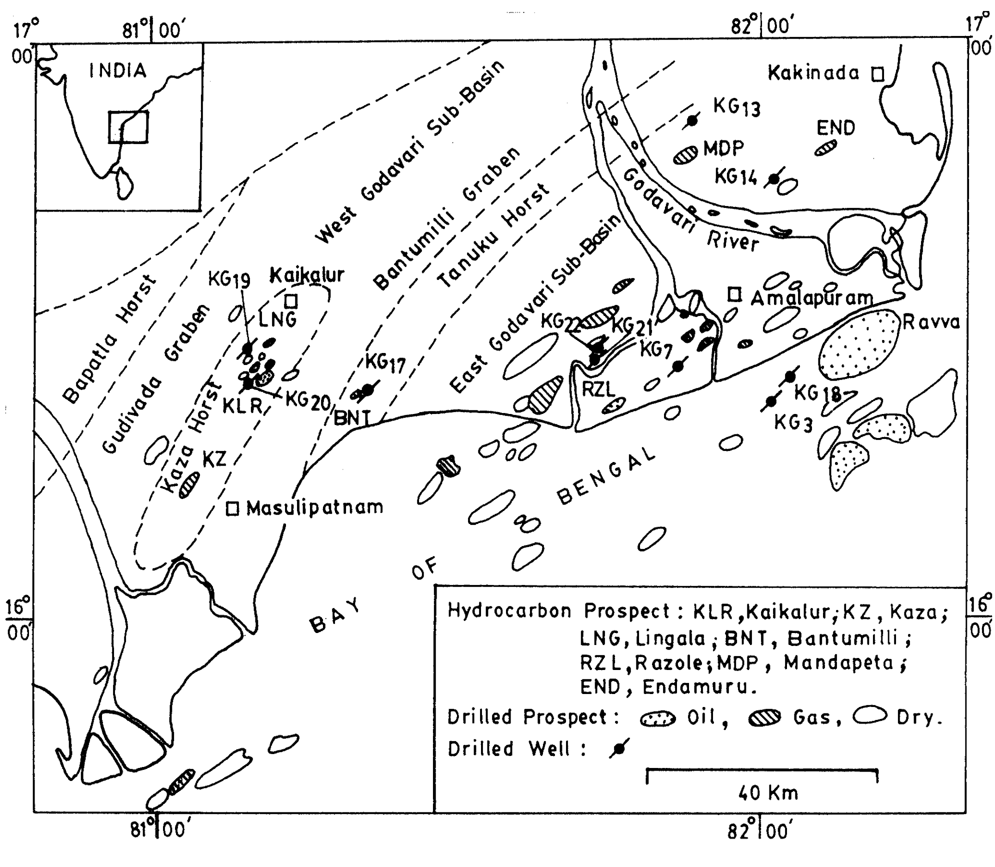

Fig. 1
Location of wells from which core samples were collected and tectonic features of the Krishna-Godavari basin. (After Sastri et al. 1981)

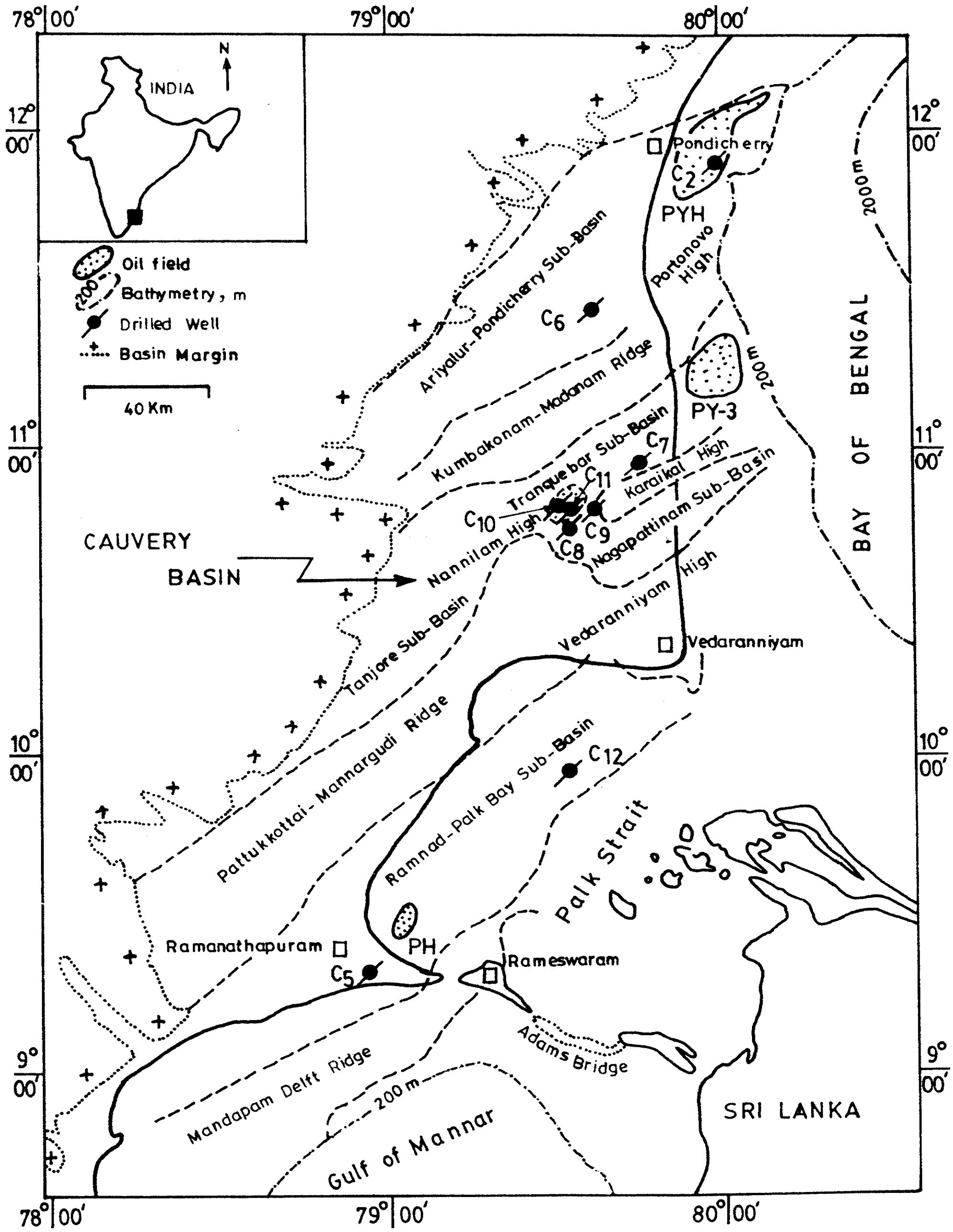

Fig. 2
Location of wells from which core samples were collected and tectonic features of the Cauvery basin. (After Sastri et al. 1981)

Petrographic description

The majority of the core samples from both the K-G and Cauvery basins were sandstones, although some from the wells in the K-G basin were siltstone, limestone, shale and augen gneiss. Most of the sandstones collected from the K-G basin were medium to coarse grained and greyish-white, greyish-green, white or dirty-white in colour, whereas the siltstones were medium to fine grained and greenish-grey, greyish-black or light brown. The main constituents of the rock samples were quartz and feldspar, with biotite, garnet and hornblende also identified. The cementing materials were calcareous, ferruginous and carbonaceous. One limestone sample was medium grained and light coloured and included such minerals as orthochem–sparite, micrite and allochem–foraminifera. The basement core sample was a coarse-grained, dark-coloured augen gneiss with quartz, feldspar, biotite and garnet.

The core samples from the wells in the Cauvery basin were dominantly sandstones and shale. The sandstone samples varied in grain size from coarse to fine grained and in colour from light grey to greyish-white and light brown. The main minerals identified were quartz, feldspar and biotite, perthite, garnet and glauconite with a calcareous or ferruginous cement. The light-brown shales were either fine or medium grained while the black shales were fine grained. The main minerals were quartz, feldspar and glauconite with clay, carbonaceous and ferruginous matter also recorded. A summary of the petrographical analyses for the core samples collected from the K-G and Cauvery basins is given in Tables 1 and 2.

Table 1
Petrophysical and elastic characteristics of rock samples cored from wells in the Krishna-Godavari basin

Well no.	Core sample no.	Core recovery depth (m)	Age	Rock type	Petrography	Dry density (gm/cm^3)	Porosity (%)	Uniaxial comp. strength (MPa)	Tensile strength (MPa)	Young's modulus (MPa)	Poission's ratio
KG_3	KGS-1	2,739.00–2,746.00	Miocene	Siltstone	Medium to finegrained; greenish-grey coloured; well sorted; quartz, feldspar; ferruginous cement	2.30	14.0	25.0	2.1	-	-
KG_7	KGS-2	2,247.00–2,252.00	Eocene	Limestone	Medium grained; white coloured; moderately sorted; orthochem–sparite, mocrite; allochem–foraminifera (fossils)	2.44	4.2	41.8	5.8	-	-
KG_{13}	KGS-3	2,880.00–2,889.00	Permo-Triassic	Sandstone	Medium grained; greyish-white coloured; poorly sorted; quartz, boitite, garnet, hornblende; calcareous and ferruginous cement	2.72	3.0	48.0	4.3	30,000	0.11
KG_{14}	KGS-4	2,867.00–2,876.00	Permo-Triassic	Sandstone	Medium grained; greyish-white coloured; well sorted; quartz, feldspar; calcareous cement	2.25	11.0	22.0	2.2	14,000	0.18
	KGS-5	3,192.00–3,201.00	Permo-Triassic	Siltstone	Medium grained; greyish-black coloured; well sorted; quartz, feldspar, mica; calcareous cement and presence of carbonaceous matter	2.51	6.0	35.0	4.2	22,000	0.11
KG_{17}	KGS-6	3,104.00–3,109.70	Cretaceous	Augen gneiss	Coarse grained; dark coloured; poorly sorted; quartz, biotite, feldspar, garnet and presence of gneissic texture	2.74	1.7	52.0	5.9	-	-
KG_{18}	KGS-7	2,761.50–2,770.50	Miocene	Siltstone	Medium grained; light brownish coloured; well sorted; quartz, feldspar, biotite; calcareous cement	2.04	18.0	15.9	1.7	15,000	0.18
	KGS-8	2,562.00–2,568.00	Miocene	Shaley sandstone	Medium grained; well sorted; white coloured; quartz, feldspar; calcareous cement	2.56	4.0	45.0	5.0	42,000	0.17
KG_{19}	KGS-9	2,119.50–2,128.50	Cretaceous	Sandstone	Medium to coarse grained; dirty-white coloured; well sorted; quartz, feldspar; ferruginous cement	1.98	22.0	8.0	0.9	-	-

Table 1
(Continued)

Well no.	Core sample no.	Core recovery depth (m)	Age	Rock type	Petrography	Dry density (gm/cm^3)	Porosity (%)	Uniaxial comp. strength (MPa)	Tensile strength (MPa)	Young's modulus (MPa)	Poission's ratio
KG_{20}	KGS-10	2,024.80–2,031.80	Creta-ceous	Sand stone	Medium grained; greyish-white coloured; well sorted; quartz, perthite, garnet, biotite; calcareous cement	2.60	7.0	37.3	4.1	28,000	0.26
KG_{21}	KGS-11	3,244.80–3,257.00	Palaeo-cene	Sandstone	Medium to coarse grained; greyish-green coloured; moderately sorted; quartz, feldspar, chert, fragments; calcareous and ferruginous cement	2.26	12.0	20.0	2.1	15,500	0.24
KG_{22}	KGS-12	3,306.00–3,311.25	Palaeo-cene	Sandstone	Fine grained; greenish-grey coloured; well sorted; quartz, feldspar; calcareous and ferruginous cement	2.50	7.0	47.0	6.5	38,000	0.21

Experimental technique

All the core samples were trimmed and lapped according to the specifications outlined in IS: 9179–1979 (Indian Standards Institution 1979b) to provide specimens with a diameter of 28 mm and a length to diameter ratio of 2:3. At least six samples were tested for dry density, uniaxial compressive strength and tensile strength and the results averaged (Tables 1 and 2). Where appropriate, test specimens were oven dried at 110 °C for 24 h. Effective porosity was determined using the mercury injection method.

Twenty-two samples were tested for uniaxial compressive strength and tensile strength in the Geomechanical Laboratory of the Central Mining Research Institute (CMRI), Dhanbad. For the former, 28 mm diameter cylindrical specimens were prepared from core samples and subjected to load at a constant stress rate (0.5 MPa/s) such that failure took place within 5 to 15 min of loading. The uniaxial compressive strength of the specimen was then calculated according to IS: 9143–1979 (Indian Standards Institution 1979a) by dividing the maximum load carried by the specimen during the test by the average original cross-sectional area.

To establish the tensile strength, cylindrical core specimens were cut into thin discs with a thickness equal to half the diameter. After cutting the sample, the ends were polished using a grinding machine and the sample placed in an air oven at a temperature of 110 °C for 24 h to remove any moisture present. The specimen was placed between the loading plates of a Brazilian test apparatus and the load applied parallel to the diameter of the specimen at a constant rate of 200 N/s such that failure in the weakest rocks occurred within 15 to 30 s. The tensile strength of the specimen is determined according to IS: 10082–1981 (Indian Standards Institution 1981). After loading the specimen diametrically, tensile strength (in kg/cm^2) is calculated by the Brazilian test by using the following expression:

$$\text{Tensilestrength} = (2 \times \text{Load})/(\pi \text{Dt})$$

where D is diameter and t is thickness.

Elastic constants

A total of 15 specimens selected for the determination of Young's modulus and Poisson's ratio by the static test were oven dried and cleaned with toulene. Of these, eight samples were from the K-G basin and the remainder from the Cauvery basin. The results are tabulated in Tables 1 and 2. These elastic parameters were calculated using IS: 9221–1979 (Indian Standards Institution 1979c). During the test the pressure on the specimen is applied continuously and without shock to produce an approximately constant rate of load (0.5 MPa/s) or deformation such that failure occurs within 5 to 15 min of initiation of loading. The load imposed and the axial as well as diametric or circumferential strains were measured frequently at evenly spaced load intervals during the test for 11 of the specimens and the axial stress-strain curve determined from 11 test measurements. Young's modulus is obtained from the slope of the axial stress-strain curve. Young's modulus (E) (in kg/cm^2)and Poisson's ratio (σ) were evaluated using:

Table 2
Petrophysical and elastic characteristics of rock samples cored from wells in the Cauvery basin

Well no.	Core sample no.	Core recovery depth (m)	Age	Rock type	Petrography	Dry density (gm/cm^3)	Porosity (%)	Uniaxial comp. strength (MPa)	Tensile strength (MPa)	Young's modulus (MPa)	Poission's ratio
C_2	CS-1	2611.00–2616.50	Creta-ceous	Sandstone	Medium to fine grained; light grey coloured; well sorted; quartz, feldspar, garnet; calcareous and ferruginous cement	2.18	18.0	17.15	2.0	12,000	0.27
C_5	CS-2	2069.00–2076.00	Creta-ceous	Shale	Fine to medium grained; weathered; light brown coloured; well sorted; glauconite, carbonate; presence of carbonaceous and ferruginous matter	2.34	6.0	23.9	2.4	-	-
	CS-3	2598.00–2602.00	Creta-ceous	Sandstone	Medium grained; greyish-white coloured; well sorted; quartz, perthite, feldspar; clay; calcareous and ferruginous cement	2.39	9.0	26.5	3.3	18,000	0.20
C_6	CS-4	4362.50–4370.82	Creta-ceous	Carb. shale	Fine grained; black coloured; poorly sorted; quartz, feldspar; clay and presence of carbonaceous matter	2.25	4.0	22.0	2.3	-	-
C_7	CS-5	2321.00–2329.30	Tertiary	Sandstone	Medium to coarse grained; light brown coloured; moderately sorted; quartz, feldspar; calcareous cement	2.00	20.0	13.4	0.8	7,000	0.22
C_8	CS-6	3051.00–3059.00	Creta-ceous	Sandstone	Medium to coarse grained; light grey coloured; well sorted; quartz, biotite, feldspar, perthite; calcareous cement	2.35	9.8	24.5	2.9	20,000	0.25
C_9	CS-7	2487.60–2492.10	Creta-ceous	Sandstone	Medium grained; greyish-white coloured; well sorted; quartz, feldspar, biotite, glauconite, garnet; calcareous and ferruginous cement	1.97	25.0	10.6	1.0	8,500	0.24
C_{10}	CS-8	3002.00–3010.90	Creta-ceous	Sandstone	Medium to coarse grained; light grey coloured; poorly sorted; quartz, feldspar, garnet, glauconite; calcareous cement	2.43	5.5	28.7	3.1	22,000	0.26
C_{11}	CS-9	2268.25–2275.25	Creta-ceous	Sandstone	Medium to fine grained; greyish-white coloured; well sorted; quartz, feldspar; calcareous cement	2.04	22.0	12.5	1.2	-	-
C_{12}	CS-10	2340.00–2346.00	Creta-ceous	Sandstone	Medium to coarse grained; light grey coloured; poorly sorted; quartz, feldspar, garnet, biotite; calcareous cement	2.41	8.6	27.5	3.3	25,000	0.16

E = Incremental stress/Incremental strain

σ = Diametric strain/Axial strain

Correlations between petrophysical and rock mechanical properties

Petrographic characteristics (e.g. density and porosity) of the sedimentary rocks from the K-G and Cauvery basins were correlated with uniaxial compressive strength using regression analysis, and tensile strength and Young's modulus were correlated with uniaxial compressive strength. Bivariant correlation provides a means of summarizing the relationship between two variables (Ulusay et al. 1994). Linear regression is the most common statistical procedure for fitting a straight line to a set of experimental data and is based on the least-square curve fitting. In addition to linear regression analysis, power ($y=ax^b$), logarithmic (y=a+lnx) and exponential ($y=ae^{bx}$) relationships between variables were also investigated. Figures 3 and 4 show the linear and best fit curves for uniaxial compressive strength and dry density, tensile strength, effective porosity and Young's modulus of core samples for the K-G basin. Similarly, Figs. 5 and 6 respectively represent the linear and best fit curves for uniaxial compressive strength and density, tensile strength, porosity and Young's modulus of core samples for the Cauvery basin.

Tables 3 and 4 provide the linear regression analysis and best fit regression analysis results for the K-G and Cauvery basins. It can be seen that the linear relationship between uniaxial compressive strength and density (R^2=0.89 for K-G basin and R^2=0.98 for Cauvery basin) yields correlation coefficients higher than those for the power, logarithmic and exponential curves. For the K-G samples, the power relationship curve for the uniaxial compressive strength/tensile strength has a higher correlation coefficient (R^2=0.94) than the linear curve (R^2=0.89), although the correlation coefficient for the best fit linear curve for uniaxial compressive strength and density (R^2=0.93) is higher than that for the other curves for the Cauvery basin data. For both the K-G and Cauvery basin data the exponential relationship between uniaxial compressive strength and porosity has a higher correlation coefficient (R^2=0.92 for K-G basin and R^2=0.87 for Cauvery basin) than the linear relationship (R^2=0.89 for K-G basin and R^2=0.83 for Cauvery basin). Similarly, for both basins the correlation coefficients of the exponential curve between Young's modulus and uniaxial compressive strength are higher (R^2=0.95 for K-G basin and R^2=0.91 for Cauvery basin) than those of linear curves (R^2=0.93 for K-G basin and R^2=0.90 for Cauvery basin).

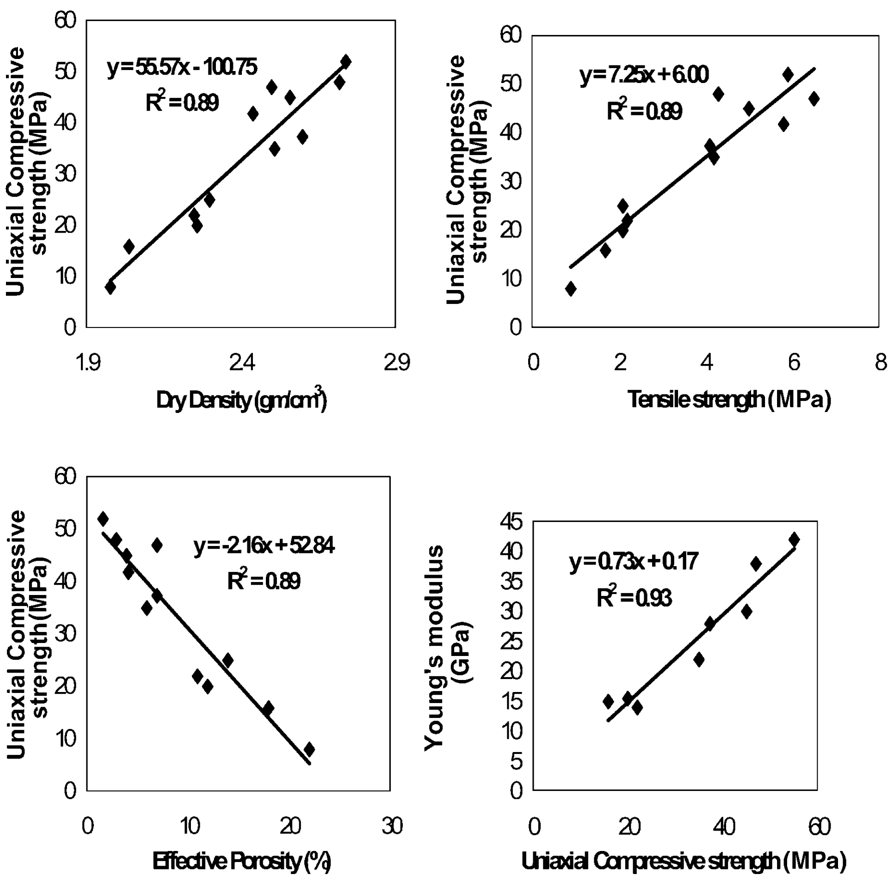

Fig. 3
Linear relationship and correlation coefficient between petrophysical and mechanical properties of cored samples from wells in the Krishna-Godavari basin. **a** Uniaxial compressive strength and dry density. **b** Uniaxial compressive strength and tensile strength. **c** Uniaxial compressive strength and effective porosity. **d** Young's modulus and uniaxial compressive strength

Discussion

Regression analysis is used to derive an equation that can be used to predict values of a dependent variable (y) from an independent variable (x). Using linear, power and exponential equations it is possible to predict the mechanical properties of sandstones from petrophysical properties. In the present study, a significant correlation is observed between uniaxial compressive strength and petrophysical properties (density and effective porosity) for the K-G and Cauvery basins. The correlation between uniaxial compressive strength and both tensile strength and Young's modulus is also significant for the K-G and Cauvery basins.

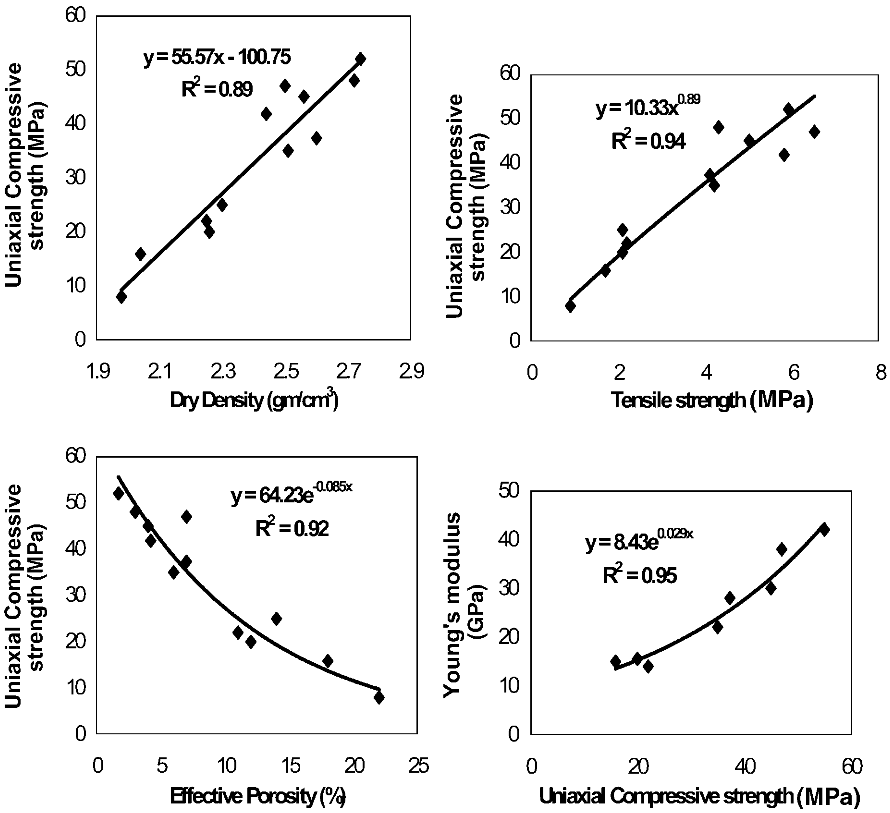

Fig. 4
Best fit relationship and correlation coefficient between petrophysical and mechanical properties of cored samples from wells in the Krishna-Godavari basin. **a** Linear relationship between uniaxial compressive strength and dry density. **b** Power relationship between uniaxial compressive strength and tensile strength. **c** Exponential relationship between uniaxial compressive strength and effective porosity. **d** Exponential relationship between Young's modulus and uniaxial compressive strength

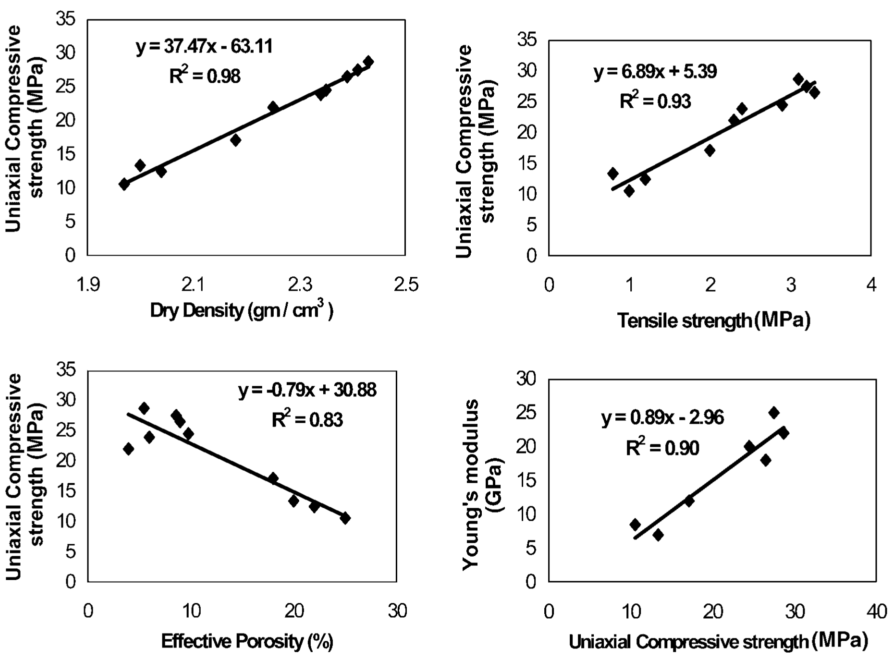

Fig. 5
Linear relationship and correlation coefficient between petrophysical and mechanical properties of cored samples from wells in the Cauvery basin. **a** Uniaxial compressive strength and dry density. **b** Uniaxial compressive strength and tensile strength. **c** Uniaxial compressive strength and effective porosity. **d** Young's modulus and uniaxial compressive strength

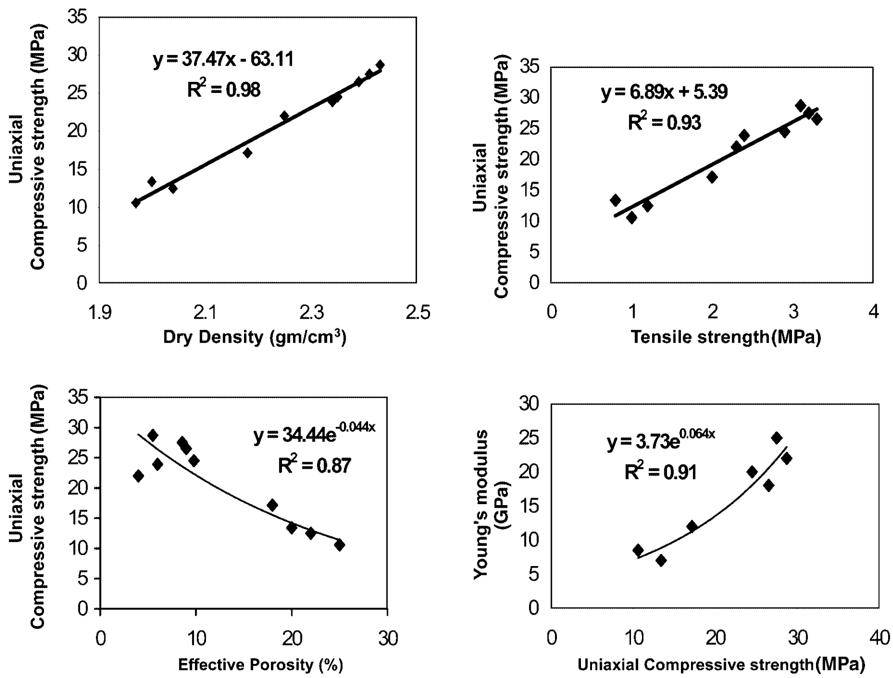

Fig. 6
Best fit relationship and correlation coefficient between petrophysical and mechanical properties of cored samples from wells in the Cauvery basin. **a** Linear relationship between uniaxial compressive strength and dry density. **b** Linear relationship between uniaxial compressive strength and tensile strength. **c** Exponential relationship between uniaxial compressive strength and effective porosity. **d** Exponential relationship between Young's modulus and uniaxial compressive strength

Table 3
Regression analysis (linear equations) of core samples from wells in the Krishna-Godavari and Cauvery basins

Basin	Fig. no.	No. of observations	Parameters related	Regression equation
Krishna–Godavari	3a	12	Uniaxial comp. strength (y) vs. dry density (x)	$y=55.57x-100.75$, $R^2=0.89$
	3b	12	Uniaxial comp. strength (y) vs. tensile strength (x)	$y=7.25x+6.00$, $R^2=0.89$
	3c	12	Uniaxial comp. strength (y) vs. effective porosity (x)	$y=-2.16x+52.84$, $R^2=0.89$
	3d	8	Young's modulus (y) vs. uniaxial comp. strength (x)	$y=0.73x+0.17$, $R^2=0.93$
Cauvery	5a	10	Uniaxial comp. strength (y) vs. dry density (x)	$y=37.47x-63.11$, $R^2=0.98$
	5b	10	Uniaxial comp. strength (y) vs. tensile strength (x)	$y=6.89x+5.39$, $R^2=0.93$
	5c	10	Uniaxial comp. strength (y) vs. effective porosity (x)	$y=-0.79x+30.88$, $R^2=0.83$
	5d	7	Young's modulus (y) vs. uniaxial comp. strength (x)	$y=0.89x-2.96$, $R^2=0.90$

Table 4
Regression analysis (best fit equations) of core samples from wells in the Krishna-Godavari and Cauvery basins

Basin	Fig. no.	No. of observations	Parameters related	Regression equation
Krishna–Godavari	4a	12	Uniaxial comp. strength (y) vs. dry density (x)	$y=55.57x-100.75$, $R^2=0.89$
	4b	12	Uniaxial comp. strength (y) vs. tensile strength (x)	$y=10.33\times^{0.89}$, $R^2=0.94$
	4c	12	Uniaxial comp. strength (y) vs. effective porosity (x)	$y=64.23e^{-0.085x}$, $R^2=0.92$
	4d	8	Young's modulus (y) vs. uniaxial comp. strength (x)	$y=8.43e^{0.029x}$, $R^2=0.95$
Cauvery	6a	10	Uniaxial comp. strength (y) vs. dry density (x)	$y=37.47x-63.11$, $R^2=0.98$
	6b	10	Uniaxial comp. strength (y) vs. tensile strength (x)	$y=6.89x+5.39$, $R^2=0.93$
	6c	10	Uniaxial comp. strength (y) vs. effective porosity (x)	$y=34.44e^{-0.044x}$, $R^2=0.87$
	6d	7	Young's modulus (y) vs. uniaxial comp. strength (x)	$y=3.73e^{0.064x}$, $R^2=0.91$

Conclusions

1. The average values of dry density for the different sedimentary rocks and basement rock of the K-G basin increase in the order: sandstone<siltstone< limestone<augen gneiss. The Cauvery basin samples support this with the dry density of sandstone<shale.
2. The values of effective porosity of the samples from the K-G basin increase in the order: augen gneiss<limestone<siltstone<sandstone, while in the Cauvery basin the order is shale<sandstone. Depending on the grain size, the values of effective porosity for the different sedimentary rocks in both basins follow the order: fine grained, poorly sorted<fine grained, well sorted<fine to medium grained, well sorted<medium to fine grained, well sorted<medium to coarse grained, poorly sorted<medium grained, well sorted<medium to coarse grained, moderately sorted<medium to coarse grained, well sorted.
3. The average values of uniaxial compressive strength and tensile strength in the K-G basin increase in the order of: siltstone<sandstone<limestone<augen gneiss, and in the case of the Cauvery basin the order is sandstone<shale. The uniaxial compressive strength of the sandstones varies from 8.0 to 48 MPa for the K-G basin and 10.6 to 27.5 MPa for the Cauvery basin. According to accepted strength classifications (e.g. Bell and Lindsay 1999) the data suggest that strong sandstone (uniaxial strength 48 MPa) as well as weak sandstones are present in the K-G basin whereas only weak sandstones are present in the Cauvery basin.
4. Young's modulus values of 30 to 42 GPa were obtained for the strong sandstone in the K-G basin, in contrast to the much lower values for the weak sandstone present in this basin and in the Cauvery basin. The average value of Poisson's ratio for the K-G core samples (sandstones) is 0.18 and for samples from the Cauvery basin, 0.23.
5. The results of the regression analysis suggest that the quantitative prediction of mechanical and physical properties is only likely to be possible for sandstones. However, additional data and further studies are needed to verify the relationships obtained.

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