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S O M M A I R E

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ENERGIE

1: **Worldwide shale-oil reserves: towards a global approach based on the principles of petroleum system and the petroleum system yield.** BLAIZOT M.

Keywords: Shale-oil resource; Reserve; Petroleum system; Petroleum system yield; World.

Abstract: In this article, we try to estimate the world-wide oil reserves from source rocks using the notion of generation potential of source rocks which is relatively well understood, as well as their retention capacity (or non-expulsion) which is less understood. Various empirical and geochemical approaches from the basin to the laboratory scale will be used to determine the retention potential of source rocks. We will also try to estimate a recovery factor for these retained fluids using analogues of petrographical, geomechanical and fluid characteristics from US shales. A recovery factor is difficult to know because little production data are available beyond the short production history of these unconventional reservoirs. Nevertheless, their production demonstrates a surprising production resilience due to the large number of wells and the possibility of refracking but also due to the better than thought petrophysical properties.

Unconventional oil (or LTO=light tight oil) is defined here in accordance with Jarvie (2012) as oil that is generated by rock formations rich in organic matter that are oil – mature and trapped either within the source rock layers or in its immediate vicinity (not more than a few meters of migration within such an extremely low permeability rock matrix). These oils did not experience secondary migration and stay in these compact reservoirs and therefore are not limited by a water-oil contact.

In: Bull. Soc. Géol. France; t. 188, n° 5, 2017, 33-9 p.

GEOLOGIE STRUCTURALE

2: New insight of the geological structures and tectonic framework of Ahnet and Northwestern part of Tin Zaouatine terranes (Western Hoggar, Algeria) constraints from aeromagnetic, gamma ray, and remote sensing data. AMARA M., HAMOUDI M., DJEMAÏ S., BENDAOUD A., DUFRECHOU G., JESSELL W.M., BOUBEKRI H., OUZEGANE K., GUEMMAMA M., MACHANE D.

Keywords: Remote sensing; Airborne geophysics; Tuareg shield; Hoggar; Algeria; Pan-African orogeny.

Abstract: The Ahnet and Tin Zaouatine terranes are located in the southern sector of the Algerian desert and are part of the Tuareg shield, which was built up during east-west shortening (Pan-African orogeny). This paper presents a new 1/200 000 geological and tectonic map of the Tin Tanet first sheet map (mainly of the Ahnet terrane and the northwestern part of the Tin Zaouatine terrane). Enhancement and processing of multispectral satellite data (Landsat 7 ETM+) combined with field campaign and aiborne geophysics was used to discriminate geological lithologies and tectonic structures. We define six geological domains : (i) Palaeozoic formation and Cambrian continental facies and plutonic rocks, (ii) Late- to post-orogenic plutonic rocks, (iii) synchronous orogenic plutonic rocks, (iv) Neoproterozoic formation, (v) Mesoproterozoic volcanics, metasedimentary rocks, and associated plutonic rocks, and (vi) Late Paleoproterozoic metasedimentary rocks. Airborne magnetic data and textural features derived from remote sensing and fieldwork allow us to identify faults and shear zones that affect the whole studied terrane. Interpreted tectonic lines and foliation paths leads us to suggest a deformation model which involves two deformation phases: an older N-S to NNE-SSW shortening D1 and a younger D2 defined by the N-S trend and a compressional character revealed in the Ahnet terrane and Camp Zohra Complex domain which is considered a continuum deformation split into three phases that affect and form structures of the whole Ahnet and the north-western part of Tin Zaouatine terranes at the Pan-African orogeny. The most recent stress field recorded in this region is expressed as NE-SW strike-slip faults.

In: Arabian Journal of Geosciences; vol. 10, n° 18, 2017, 396-20 p.

3: Structural evolution of Cenozoic basins in Northeastern Tunisia, in response to sinistral strike-slip movement on the El Alia-Teboursouk fault. BEJAOUI H., AÏFA T., MELKI F., ZARGOUNI F.

Keywords: Folds; Cenozoic; Wells; Seismic; El Alia-Teboursouk fault; Tunisia, Algeria.

Abstract: This paper resolves the structural complexity of Cenozoic sedimentary basins in Northeastern Tunisia. These basins trend NE-SW to ~ E-W, and are bordered by old fracture networks. Detailed descriptions of the structural features in outcrop and in subsurface data suggest that El Alia-Teboursouk fault zone in the Bizerte area evolved through a series of tectonic events. Cross sections, lithostratigraphic correlations, and interpretation of seismic profiles through the basins show evidence for: (i) a Triassic until Jurassic-Early Cretaceous rifting phase that induced lateral variations of facies and strata thicknesses; (ii) a set of faults oriented NE-SW, NW-SE, N-S, and E-W that guided sediment accumulation in pull-apart basins, which were subject to compressive and transpressive deformation during Eocene (Lutetian-Priabonian), Miocene (Tortonian), and Pliocene-Quaternary; and (iii) NNW-SSE to NS contractional events that occurred during the Late Pliocene. Part of the latest phase has been the formation of different synsedimentary folded structures with significant subsidence inversion. Such events have been responsible for the reactivation of inherited faults, and the intrusion of Triassic evaporites, ensuring the role of a slip layer. The combined effects of the different paleoconstraints and halokinetic movements are role of a slip layer. The combined effects of the different paleoconstraints and halokinetic movements are at the origin of the evolution of these pull-apart basins. The subsurface data suggest that an important fault displacement occurred during the Mesozoic-Cenozoic. The patterns of sediment accumulation in the different basins reflect a high activity of deep ancient faults.

In: Journal of African Earth Sciences; vol. 134, 2017, p. 174-197.

4 : Origine de la chaîne des Pyrénées: collision entre les plaques ibérique et européenne ou inversion d'un ancien rift intracontinental avorté ? CANEROT J.

Mots-clés: Sillon flysch; Marges passives; Transtension; Transpression; Pyrénées; Europe; Ibérie.

Résumé: Par leur longue gestation, leur structure et leur style de déformation, les Pyrénées demeurent une chaîne montagneuse singulière, difficile à classer, notamment en termes de tectonique des plaques. Pour certains, il s'agit d'une chaîne de collision résultant de l'affrontement des plaques Europe et Ibérie. L'interprétation se fonde alors essentiellement sur la présence d'une croûte océanique mésozoïque aujourd'hui disparue, séparant deux marges passives à croûte continentale de type atlantique. La distension interplaque aurait, au cours du Crétacé inférieur, induit un amincissement crustal extrême avec détachement régional et décoiffement mantellique au droit d'un long fossé correspondant au sillon nord-pyrénéen. Les affleurements de iherzolites seraient les témoins actuels privilégiés de cette dénudation. Pour d'autres, les Pyrénées doivent plutôt être définies comme résultant de la fermeture d'un bras de rift crétacé nord-pyrénéen composite, par la tectonique compressive tertiaire. La création de cette déchirure se serait effectuée par transtension, selon un mouvement en ciseau, d'Ouest en Est, avec ouverture océanique nette sur le seul fossé occidental de Bilbao. Dans les Pyrénées, le manteau iherzolitique ne serait dénudé que ponctuellement, dans le seul bassin occidental de Mauléon. La fermeture du rift se serait à l'inverse réalisée par transpression, d'Est en Ouest, graduellement, induisant un racourcissement important dans les Pyrénées orientales et plus faible dans la partie occidentale de la chaîne. C'est cette deuxième interprétation qui est privilégiée dans le présent travail.

In: Bull. Soc. Hist. Nat Toulouse; t. 153, 2017, p. 95-110.

5 : Etude du comportement du matériel triasique lors de la structuration de l'extrémité orientale de l'Atlas Saharien en Algérie: impact sur le prospect pétrolier. CHACHA A., ZELLOUF KH., BELFAR F.

Mots-clés: Diapirisme; Resédimentation; Evaporites; Structure; Prospect pétrolier; Atlas Saharien Oriental; Algérie.

Résumé: La région d'étude est située à l'extrémité Est de l'Atlas Saharien Oriental; elle est caractérisée par une succession d'anticlinaux et de synclinaux de direction NE-SO à ENE-OSO, avec des diapirs occupant les coeurs de certains plis, des fossés d'effondrement orientés globalement NO-SE et un réseau dense d'accidents de directions principales: NO-SE, NE-SO, E-O et N-S.
Les terrains rencontrés dans la région d'étude sont d'âge méso-cénozoïque, constitués de faciès essentiellement marins, argilo-carbonatés intercalés épisodiquement par des dépôts argilo-gréseux correspondant au Néocomien, au Barrémien, à l'Albien inférieur et au Miocène.
Le matériel évaporitique du Trias montre une mobilisation volumétrique importante, il se présente sous forme de lentilles resédimentées et de diapirs (Vila, 1993; Herkat, 1988).

L'initiation de la mobilisation de matériel évaporitique s'est opérée durant l'Albo-Aptien, elle est liée à la distension (en blocs basculés) qui a caractérisé l'Atlas Saharien Oriental durant le Crétacé inférieur (Vila, 1980).
Le mécanisme qui peut être retenu pour le développement des diapirs de l'Atlas Saharien Oriental semble se rapprocher du modèle défini en Mer du Nord où un accident de socle est réactivé (Vendeville, 1987).
Le choix de cette région pour l'étude du diapirisme est guidé essentiellement par l'intensité de ce phénomène et par les conséquences pétrolières qui peuvent en résulter. En effet, plusieurs découvertes d'hydrocarbures liées à ce mouvement sont connues, dans le Golfe du Méxique, la Mer du Nord et l'Iran.

In: Mémoire du Serv. Géol. Algérie; n°20, 2018, p. 139-156.

6 : Polyphasic evolution of the Jeffara Basin in Southern Tunisia, influence of halokinesis on the passive margin structuration in the Mesozoic and the Cenozoic. KHOUNI R., ARFAOUI M.S., DRIDI S.

Keywords: Seismic data; Geodynamics; Subsidence; Halokinesis; Jeffara; Tunisia.

Abstract: During the Mesozoic and Cenozoic rifting, the Pelagian sea recorded the consequences of the African and European plate's rapprochement. The interpretation of surface and subsurface data that is the 2D seismic reflection and petroleum well data show new ideas on the geodynamic evolution and halokinesis of the Jeffara Basin during the Mesozoic and Cenozoic period. Seismic lines interpretations of the subsurface mainly reveal normal syn-sedimentary NW-SE faulting and where the Jeffara fault seems to be the major play.
This syn-sedimentary faulting induced horst and graben structures materialized by major sedimentary sequences thicknesses as well as depths variations on the seismic profiles from the Jeffara fault zone overall towards the East of Jeffara Basin. After the Hercynian event of the Permian – Carboniferous age, a general extension took place, which gave rise to the Tethyan opening. This extension has favored the individualization of the Jeffara Basin in the South East of Tunisia, characterized by a structuring in Horst and Graben with a Permian carbonate subsidence. During the Triassic – Middle Jurassic period, the Jeffara basin is marked by a pronounced subsidence of essentially evaporate sedimentation accompanied by the birth of normal syn-sedimentary NW-SE faults following an NE-SW extension. This subsidence continuing during the Upper Jurassic period, the accentuation of which is towards the NE of the study zone at the Jerba and El Bibane sub-basin with a dominance of bioclastic limestone and dolomites sedimentation in the same extensive NE-SW direction, during this period, the Jeffara Basin was characterized by a beginning of salt activity indicated by the appearance of salt nuclei at the base of the preexisting NW-SE normal faults. During the Lower Cretaceous, we are witnessing an individualization of salt complexes in the SE of the study area at Rass Ajil sub-basin, where this reactive diapirism has produced high zones and erosions in the crest above the salt bodies. During the mid Cretaceous period, the Zebbag formation, hatched by the Gattar carbonate bar, recorded a subsidence inversion phenomenon between the three sub-basins Jerba, El Bibane and Rass Ajil sub-basin, and showed the change of movement of the African plate relative to the European plate related to the opening of the North Atlantic and the beginning of the drift towards the North Africa. This phenomenon is concretized towards the Upper Cretaceous, where we witness a strong subsidence towards the southeastern part of the study area at Rass Ajil sub-basin with sandstone, marl and clay sedimentation under a regional extensive regime and the individualization of high zones at Jerba sub-basin. The salt movements present an active aspect by piercing their cover and inducing rim synclines in the surroundings. The Cenozoic period is characterized by a strong subsidence of sandstone, clays and carbonates along the Jeffara Basin, the salt activity shows a passive aspect at the beginning of this period which slows down and eventually stopped at the late Miocene period, thus indicating the probable exhaustion of the source of the salt material.

In : Arabian Journal of Geosciences; vol. 11, n° 4, 2018, 68-22 p.

7 : The Tell-Rif orogenic system (Morocco, Algeria, Tunisia) and the structural heritage of the Southern Tethys margin. LEPRÊTRE R., FRIZON DE LAMOTTE D., COMBIER V.

Keywords : Coupling vs decoupling; Frontal accretion vs tectonic underplating; Tell-Rif orogenic system (Algeria, Morocco, Tunisia); Tethys; West Mediterranean.

Abstract: The Tell-Rif (Tell in Algeria and Tunisia; Rif in Morocco) is the orogenic system fringing to the south the west Mediterranean basins. This system comprises three major tectonic-palaeogeographic zones from north to south: (1) the internal zones (AlKaPeCa for Alboran, Kabylies, Peloritan, Calabria) originating from the former northern European margin of the Maghrebian Tethys, (2) the « flyschs zone » regarded as the former cover of the oceanic domain and (3) the external zones, forming the former southern Maghrebian Tethys margin more or less inverted. The Tell-Rif is interpreted as the direct result of the progressive closure of the Maghrebian Tethys until the collision between AlKaPeCa and Africa and, subsequently, the propagation of the deformation within Africa. This gives a consistent explanation for the offshore Neogene geodynamics and most authors share this simple scenario. Nevertheless, the current geodynamic

models do not completely integrate the Tell-Rif geology. Based on the analysis of surface and sub-surface data, we propose a reappraisal of its present-day geometry in terms of geodynamic evolution. We highlight its non-cylindrical nature resulting from both the Mesozoic inheritance and the conditions of the tectonic inversion. During the Early Jurassic, we emphasize the development of NE-SW basins preceding the establishment of an E-W transform corridor connecting the Central Atlantic Ocean with the Ligurian Tethys. The Maghrebian Tethys developed just after, as the result of the Late Jurassic-Early Cretaceous left-lateral spreading beetween Africa and Iberia. By the Late Cretaceous, the occurrence of several tectonic events is related to the progressive convergence between the two continents. A major pre-Oligocene (pre-35 Ma) compressional event is recorded in the Tell-Rif system. The existence of HP-LT metamorphic rocks associated with fragments of mantle in the external metamorphic massifs of the Eastern Rif and Western Tell shows that, at that time, the western part of the North African margin was involved in a subduction below a deep basin belonging to the Maghrebian Tethys. At the same time, the closure of the West Ligurian Tethys through east-verging subduction led to a shift of the subduction, which jumped to the other side of AlKaPeCa involving both East Ligurian and Maghrebian Tethys. Slab rollback led to the development of the Oligo-Miocene back-arc basins of the West-Mediterranean, reworking the previous West Ligurian Tethys suture. The docking of AlKaPeCa against Africa occurred during the Late Burdigalian (17 Ma). Subsequently, the slab tearing triggered westward and eastward lateral movements that are responsible for the formation of the Gibraltar and Tyrrhenian arcs respectively. The exhumation of the external metamorphic massifs occurred through tectonic underplating during the westward translation of the Alboran domain. It resulted in the formation of both foredeeep and wedge-top basins younger and younger westward. The lack of these elements in the eastern part of the systems signs a different evolution dominated by frontal accretion. In the discussion, we precisely address the origin of the non-cylindrical behavior of the orogenic system and question the mechanisms explaining at large scale the phases of coupling/uncoupling between the major plates.

In: Bull. Soc. Géol. France – Earth Sciences Bulletin; t. 189, n° 2, 2018, 10-35 p.

8 : Saghro Group in the Ougnat Massif (Morocco), an evidence for a continuous Cadomian Basin along the Northern West African Craton. MICHARD A.

Keywords : Cadomian; Anti-Atlas; Ougarta; Hoggar; Pan-African.

Abstract: The Saghro Group (SG) is a folded, low-grade volcano-sedimentary series up to 8 km thick that crops out within and to the north of the Pan-African suture zone in the central and eastern Anti-Atlas. Here we describe the SG of the Ougnat inliers that are exposed in the easternmost Anti-Atlas beneath the unconformable, Late Ediacaran Ouarzazate Group (OZG) volcanic rocks. The Ougnat SG mostly consists of volcaniclastic greywackes accumulated in a peritidal-to-shallow basin. The basin infilling was deformed by NNE-trending, mostly upright folds with axial-planar slaty cleavage and low-grade metamorphism. The deformed SG rocks were intruded by the ~550 Ma Mellab hypovolcanic granodiorite. The latter also crosscuts the lowest OZG rocks that are dated to 574-571 Ma in the western Saghro region. The SG rocks that form the Siroua and Saghro inliers have an oldest age of 620-610 Ma and were folded at ~610-580 Ma at the onset of the Cadomian orogenic events. We show that the SG rocks are similar to the « série verte » (SV) rocks that are exposed in the Ougarta and western Hoggar east of the Pan-African suture. We infer that the SG and SV rocks accumulated in a same, continuous basin that was bounding the West African Craton to the north and the east. This strongly subsiding basin formed close to a volcanic arc and was folded during the last Pan-African synmetamorphic events. Fold orientation and age of folding differ however along the edge of the West African Craton. The orogenic greywackes that form the remnants of the SG-SV basin thus constitute a precious record of the diachronic Cadomian event s.l. along the West African Craton northern margin.

In: C. R. Acad. Geoscience; vol. 349, n° 2, 2017, p. 81-90.

9 : Determining the role of lineaments in underground hydrodynamics using Landsat 7 ETM+ data, case of the Chott El Gharbi Basin (Western Algeria). TAKORABT M., TOUBAL A.CH., HADDOUM H., ZERROUK S.

Keywords: Landsat 7 ETM+; Lineaments; Geophysical methods; Groundwater flow; Chott El Gharbi; Algeria.

Abstract: This paper attempts an overview of the application of remote sensing to groundwater studies. Its objective is to define the role of the geological features in the underground hydrodynamic in the aquifer system of the Chott El Gharbi Basin (Algerian western high plains) and identify a link between the fracturing and the meteoric water supply of this deep aquifer. The methodology followed consists to study the fracturing map of studied area which is obtained after Landsat 7 ETM+ processing images. It is based on structural lineaments mapping. The obtained map has been validated by geophysical results and geological map. Statistical analysis of the lineaments network shows the presence of about 537 lineaments divided into four families oriented according to the following directions NE-SW, NW-SE, N-S, and E-W.

The lineament analysis of the studied basin provides important information on subsurface fractures that may control the circulation and storage of groundwater. These fractures have an undeniable hydrogeological interest because of their size, a priori favorable for the aquifers recharge in the region. The probable link between the Chott El Gharbi implementation and the presence of mega fractures which some of them correspond actually to Wadis is confirmed. The correlation between the productivity of high debit drillings and the closest lineament confirms that these lineaments are surface traces of regional discontinuities and act as main groundwater flow paths.

In: Arabian Journal of Geosciences; vol. 11, n° 4, 2018, 76-19 p.

STRATIGRAPHIE

10 : The red sea depositional architecture: insights from 3D modeling. ALMALKI KH.A., MAHMUD S.A., HASHEM H.I.

Keywords: 3D model; Stratigraphy; Lithology; Paleogeography; Paleoenvironment; Red Sea.

Abstract: More than half a century of geological and exploration studies have taken place in the Red Sea area, and still very limited information is available to the geological community in regard to the lithological distribution and the stratigraphic architecture. In this study, extensive well data was used to build the first lithologic and stratigraphic 3D models of the entire Red Sea to better understand the lithological distribution. The potential models have been constrained by bathymetric and geophysical data. Studied data demonstrate that up to 5 km of sediments were deposited in the Red Sea. It is mainly comprised of limestones, evaporites, and shales. Our models show that the evaporite body represents more than 70% of the Red Sea succession. In particular, the evaporite succession seems to be well developed in the southern region. Salt dome features are present and developed close to the margins. The models suggest that domal formation did not enable thick carbonate accumulation in some parts of the basin but the carbonate generally follows the evaporite trend. The models help to identify the main controls leading to salt diapir by highlighting the distribution of this body and the geometry of geological structures. Syn-rift faulting and rifting has been one of the most prominent structural features.

Complex inteplay of tectono-stratigraphic events played a significant role in shaping the stratigraphic evolution of the Red Sea Basin with multiple evolution phases of paleoenvironment and paleogeographic were recognized based on the models. Our synthesis and interpretation support that moderately deep marine conditions dominated in the Miocene, whereas shallow seas dominated the whole basin during the Plio-Pleistocene period as a result of episodic marine invasion. However, lacustrine environment may have prevailed at the Oligocene time in isolated half grabens.

In : Arabian Journal of Geosciences; vol. 11, n° 11, 2018, 277-16 p.

11 : Biostratigraphy of Upper Cretaceous through Paleocene successions in Grombalia, Tunisia (Southern Tethyan domain) – reworking processes and interpretations. AMRI A., BEN FADHEL M., CHERMITI A.

Keywords: Late Paleocene; Reworked deposits; Planktic foraminifera; Syntectonic redeposition; Grombalia; Tunisia

Absract: Revision of Late Cretaceous through Paleocene planktic foraminiferal zonal schemes for Northeastern Tunisia (Khanguet El Hajjej and Sidi Rhilaine section) has provided new insights into the biostratigraphic framework of the Abiod formation. A late Paliocene age is endowed with this unit based on the occurrence of the Late Cretaceous reworked microfauna associated with *Morozovella velascoensis* planktic foraminifera. The biostratigraphic equivalent, between the *mayaroensis* and *velascoensis* zones near J. Barka, includes an occasional submarine reworking of sediments induced by mass flow transport, indicated by the presence of microfaunal content and heterogeneous extraclasts. The internal organization of sediment (olistoliths, mass flow deposits) reflects tectonic activity and clear evidence of redeposition during the late Paleocene.

In: Arabian Journal of Geosciences; vol. 11, n° 11, 2018, 253-11 p.

12 : Présence d'un Paléocène marneux marin appartenant à la série-type de Sellaoua au Nord de Souk-Ahras: implications paléogéographiques sur les Maghrébides en Algérie orientale. CHOUABBI A., CHABBI A., CHERMITI A., BEN YOUSSEF M., KOUADRIA T.

Mots-clés: Marnes marines; Foraminifères; Paléocène; Maghrébides; Séries Sellaoua; Souk Ahras; Algérie.

Résumé : Les dépôts marneux d'âge paléocène attribués à la série de Sellaoua ont été décrits pour la première fois dans la région d'Aïn Fakroun (Voûte, 1967), faisant partie de la série géologique de Sellaoua. Leur extension ne semble pas être signalée au-delà de cette localité, depuis la région de Chebket Sellaoua jusqu'à la frontière tunisienne.
De nouvelles datations basées sur les foraminifères planctoniques attestent la présence d'un Paléocène marneux en continuité avec le Sénonien dans la série géologique de Sellaoua, située au nord de Souk-Ahras. Il s'agit de deux affleurements, le premier à Djebel Bouallègue et le deuxième, au niveau de la mine de fer de Chaâbet el Ballout.
La présence des dépôts paléocènes au nord de Souk-Ahras suggère que le fonctionnement du sillon Sellaoua dans sa partie orientale ne s'est jamais interrompu et ce, depuis le Sénonien supérieur. A l'inverse, sa partie orientale connaît vers la fin du Maastrichtien un arrêt total de la sédimentation.
Cette évolution ne peut s'expliquer que par un soulèvement du sillon dans sa partie médiane. Cette géométrie correspond à la naissance, au début du Paléogène dans le bassin Maghrébin de zones émergées et de zones de sédimentation en milieu profond.

In : Mémoire du Serv. Géol. Algérie; n°20, 2018, p. 107-113.

13 : De l'Hercynien à l'Alpin dans le massif du Chenoua: chronologie des évènements. DAHOUMANE A., NEDJARI A., AÏT OUALI R., BERKAN M., OUSTANI A.

Mots-clés: Hercynien; Alpin; Permien; Trias; Chenoua; Algérie du Nord.

Résumé: Le passage du cycle hercynien au cycle alpin est une période dominée par deux événements majeurs à l'échelle de la planète: une inversion dans la cinématique des plaques et une crise biologique, la plus dramatique qu'ait connue la terre, celle du Permien. Nous avons voulu à travers ce travail, décrypter les évènements majeurs au passage Hercynien – Alpin en Algérie du Nord. Dans cette vaste région, il ne subsiste de l'histoire hercynienne que de rares témoins, compliquant de ce fait la description de cette transition.
Dans le Mont du Chenoua (Tipaza), la coupe de Ras el Amouche offre des affleurements qui permettent son analyse assez fine. En effet, ils montrent trois ensembles séparés par des discordances et caractérisés par des lithologies et des évènements particuliers:

- un ensemble I carbonifère avec quatre unités limitées par des contacts anormaux. Les faciès assimilables à des turbidites, montrent une certaine mobilité, une schistosité (unité 1), des plissements (unité 2), des plis couchés syn-schisteux et des slumps (unités 3 et 4). Ces unités auraient été superposées par un évènement tectonique important. Par analogie avec ce que l'on connaît au Maroc varisque (Nedjari, 1991; Piqué, 1995) ces unites pourraient être du Viséen;
- un ensemble II en discordance angulaire sur le précédent: en raison des faciès de type playa argilo-gréseux rouges à pédogenèses, qui le composent, similaires à ceux des bassins de Béchar, d'Illizi et de la Grande Kabylie, nous pensons qu'il est d'âge permien. En effet, au cours de cette période, le context de la crise et la présence de la chaîne hercynienne ourlant le Gondwana à l'Ouest instaurent un climat aride à l'origine du développement généralisé de faciès de ce type, datés permiens à Béchar (Nedjari, 1991), à Illizi (Attar, 1981) et à Tikjda (Brarti, 1994);
- un ensemble III triasique en discordance sur les terrains précédents, il forme l'essentiel avec ses 100 m. C'est une série détritique grano et stratodécroissante composée de quatre formations (I à IV). Les deux premières (I et II) présentent sensiblement les mêmes faciès et organisation avec respectivement des conglomérats, des grès et des argiles continentaux.

Avec la formation III, les corps conglomératiques s'estompent au profit des grès et des argiles. La sédimentation associe maintenant des cônes alluviaux distaux, du fluviatile et des faciès de playa. Les pédogenèses en fin de formations sont importantes et rythment cette évolution.

La formation IV est essentiellement gréseuse littorale avec des dépôts de tempêtes. Une certaine mobilité se dessine avec de slumps, des failles synsédimentaires et des séismites. Elle annonce les bouleversements alpins. La fin de la série triasique est une période de longue stabilité au cours de laquelle se développent des encroûtements (ferricrêtes-calcrêtes) fréquents et rapprochés dans les derniers mètres.

Ils annoncent la fin d'une histoire et le début d'une autre, celle plus mouvementée du Jurassique.

In: Mémoire du Serv. Géol. Algérie; n°20, 2018, p. 115-127.

14 : New data on the Lower Mesozoic basal series of the Traras mounts (Tlemcen, Northwestern Algeria). FERHAT M., AIT OUALI R.

Keywords: Red series; Upper Triassic; Alluvial fan; Lacustrine deposits; Volcanic evidences; Half-grabens; Tlemcen; Algeria.

Abstract: The lower Mesozoic of the Traras mount starts with the so-called red series, which lays uncomformably on the folded and granitized Paleozoic basement. This series is overlain by Middle Liassic limestones. On the basis of its lower and upper limits and the lack of dating evidence, former authors attribute a Permian to lower Liassic (Sinemurian) age for this series. Palynological results allow to range it in the Upper Triassic probably Norian-Rhetian. The red series is studied from five sections that depict important thickness and facies variations from southwest to the northeast, inferring the irregularities of the Hercynian erosional surface. In the Central Traras, this series shows over 130-m-thick micaceous sandy conglomeratic units, deposited within alluvial fans, where the bedrock source corresponds to granite of Nedroma or its equivalent. In the Southern and Eastern Traras, where series' thickness respectively does not exceed 30 m and averages 40-80 m, besides alluvial deposits issued from hercynian basement erosion, it exhibits volcanic evidences interbedded by lacustrine deposits. Vertical and spatial distribution depicts synsedimentary infilling of narraow elongated rift basins, typically half-grabens, bounded on one side by a normal fault or a series of normal faults trending NNE-SSW to NW-SE, inherited from the hercynian event.The study of tectonostratigraphic units permitted to put forward geodynamics of the infilling basins.

In: Arabian Journal of Geosciences; vol. 10, n° 15, 2017, 338-21 p.

15: The Carboniferous in the stratigrahic table of Germany 2016. HERBIG H.-G, SALAMON M., AMLER M.R.W.

Keywords: Geochronology; Lithostratigrahy. Regional standard profiles; Pennsylvanian; Mississippian; Germany.

Abstract: The Carboniferous timescale in the stratigraphic table of Germany 2016 (STD 2016) relies on slightly modified composite ages already used in the stratigraphic table of Germany 2002 (STD 2002). They differ from the geological time scale 2012 (GTS 2012). Besides the international stages, the western European Mississippian regional stages are shown. The traditional German subdivision of the Kulm was discarded. Mississippian (lower Carboniferous) sedimentary successions are widespread in the mountainous regions and hills in the central part of Germany (Rhenish mountains, Harz, Thuringian forest, Franconian forest and adjoining regions of Saxony). They are also widespread in the subsurface of Northern Germany. Paralic Pennsylvanian (Upper Carboniferous) successions crop out in the Subvariscan Basin between Aachen and Osnabrück, and continue into the subsurface of Northern Germany. Intramontane successions, with few exceptions starting in the Pennsylvanian, occur in several, in part extended basins in southwestern and central Germany. They are known from outcrop and subsurface. The diversified facies of the Carboniferous in Germany is controlled by the northwestern progradation of the Variscan Orogeny and its finalisation during the late Westphalian. During the Mississippian, megafacies realms include deeper water basinal sediments and flysch deposits, and laterally adjoining shallow-water platform carbonates ("Kulm facies" and "Carboniferous limestone facies", respectively). Locally starting in the later Mississippian (Upper Visean), paralic and purely continental intramontane molasse deposits prevail during the Pennsylvanian. The traditional lithostragraphic terms of the Mississippian regional standard profiles of Aachen and the Western and Northern Rhenish mountains (Velbert, Sauerland) were completely substituted by new formations. Lithostratigraphic terms of the Northeastern and Eastern Rhenish mountains (kellerwaled, Lahn-Dill area) were completely revised, as provenance analyses of detrital zircons enabled the differentiation of Rhenohercynian and Armorican nappes. Also the Mississippian of the Thüringisch-Fränkisches Schiefergebirge and Frankenwald (Franconian forest) are better differentiated; formations were introduced for most lithostratigraphic units. Minor modifications concern the Namurian of the Subvariscan Basin at the northwestern border of the Rhenish mountains and the intramontane Pennsylvanian successions of several basins in central Germany.

In: Zeitschrift der Deutschen Gesellschaft für Geowissenschaften; vol. 168, n° 4, 2017, p. 483-502.

16: The stratigraphic table of Germany 2016: Proterozoic to Silurian. KEMNITZ H., EHLING B.-C., ELICKI O.

Keywords: Stratigraphy; Neoproterozoic; Early Palaeozoic; Allochthonous; Germany

Abstract: The comments to the stratigraphic table of Germany (ESTD 2005) included most complicated and controversial chapters on the Proterozoicc to Silurian periods, largely due to the inclusion of disputed allochthonous tectonostratigraphic units. Meanwhile, several of the Proterozoic to/and Early Palaeozoic former stratigraphic units of the Variscides have been re-evaluated, concerning the Erzgebirge, the Saxon granulite massif, the Schwarzburg antiform,

parts of the Southern and Central black Forest, the Bavarian Forest ("Bayerischer Wald") and the Upper Palatine Forest ("Oberpfälzer Wald"), and the Eckergneiss Complex in the Harz mountains. The stratigraphic table of Germany 2016 (STD2016) shows the age range of the protoliths recognised in these regions (see detailed information below). The stratigraphic table of Germany 2016 presents an actualised version of the STD 2005 taking into account new biostratigraphic and geochronologic data. The allochthonous nature of some of the units previously treated as part of the stratigrahic sequence is stressed for the first time.

In: Zeitschrift der Deutschen Gesellschaft für Geowissenschaften; vol. 168, n° 4, 2017, p. 423-446 .

17: The Devonian time scale in the Stratigraphic Table of Germany 2016 (STG 2016). MENNING M., GLODNY J., BROCKE R.

Keywords: Devonian; Geologic time scale; Confidence limits; Radio-isotopic age determinations; Lithostratigraphy; Correlation; Facies; Events; Markers; Germany.

Abstract: In the Stratigraphic Table of Germany 2016 (STG 2016, in German), the timing of stages within the Devonian is derived using relevant Radio-Isotopic Age determinations (RIA) from the period between 1990 and 2017. Rounding of the ages to whole millions of years is applied, to avoid misleadingly precise reporting of calculated values. The age of the Silurian-Devonian boundary in the STG 2016 is set to 418 Ma, but data would also permit a value of 419 Ma. The Devonian-Carboniferous boundary has an age of 361 Ma in STG 2016, based on formally published RIA, which is in contrast to the age value of 358.9 ± 0.4 Ma proposed in the global time scale 2012 (GTS 2012). The ages of stage boundaries in time intervals lacking relevant RIA are estimated using the time ruler of Weddige (1996). The temporal relations between the seven global stages of the Devonian presented by Tucker et *al*. (1998) continue to be valid.

In: Zeitschrift der Deutschen Gesellschaft für Geowissenschaften; vol. 168, n° 4, 2017, p. 465- 482 .

18 : Le Gourara-Timimoun: de la synéclise hercynienne atypique aux continentaux. NEDJARI A., AÏT-OUALI R.

Mots-clés: Hercynien; Carbonifère; Continental Intercalaire; Stratigraphie; Timimoun; Algérie.

Résumé : Les principaux résultats des travaux géologiques consacrés au bassin de Timimoun (Sahara algérien) depuis les années 70 sont:

- La carte géologique au 1/500 000, feuille NH 31-S0 (Lefranc et Conrad, 1974);
- Un découpage stratigraphique des séries de la fin du Dévonien et du Carbonifère à base de Goniatites (Conrad, 1966 et 1984; Legrand-Blain, 1971; 1974; 1980 et 1985);
- L'ébauche des grands traits structuraux de cette région à partir des données aéromagnétiques et de la sismique (travaux des pétroliers *In*: Beghoul, 1991, en particulier).

A partir des années 90, à l'occasion de la réalisation de thèses, de mémoires et de publications, nous avons revisité ce bassin atypique dont la durée de vie hercynienne est écourtée à la fin du Viséen supérieur-début du Namurien (?) en liaison avec une chute eustatique enregistrée à l'échelle mondiale (Ross, 1985). Nous avons ainsi:

- analysé son remplissage sédimentaire complexe, en utilisant l'outil séquentiel, en intégrant l'eustatisme, la subsidence et en approchant ses caractéristiques géodynamiques au cours de l'Hercynien;
- repris le levé des formations de la fin du Dévonien et du Carbonifère en raison des différences d'observations et de visions dans les documents en usage. Le résultat est un découpage en formation et séries. Une phase tectonique précoce intra-tournaisienne engendre des replis et multiplie localement les épaisseurs. Il fallait en tenir compte.

Cette contribution fait le point sur la structuration de ce bassin, son organisation et sa stratigraphie. Les points nouveaux, liés à son caractère atypique, sont développés : le passage Dévonien-Carbonifère, la tectonique intra-tournaisienne, les données en matière de biostratigraphie, celles de Bockwinkel et *al*. (2010).

Le Continental Intercalaire, analysé à travers deux coupes, celles d'Ighzer et d'El Ouajda, remet en cause, ici, l'idée du tout continental durant le Crétacé inférieur; il est bien littoral localement. Les observations proviennent, certes, d'une seule coupe, mais les faits sont indéniables. Il conviendrait dans le futur, de prendre en charge cette révision à travers l'étude systématique des coupes de la région de Timimoun, au moins dans un premier temps, puis de l'étendre au Sahara.

Cette mise au point montre que la connaissance de ce bassin atypique est à compléter notamment par des coupes détaillées, en particulier sur le flanc sud qui montre des différences en raison de l'exisence d'un accident majeur, pour mieux cerner l'organisation des corps sédimentaires et son évolution géodynamique qui reste à parfaire.

In: Mémoire du Serv. Géol. Algérie; n°20, 2018, p. 5-52.

19: The Devonian in the Stratigraphic Table of Germany 2016. SCHINDLER E., BROCKE R., BECKER TH.

Keywords : Regional stratigraphy; Lithostratigraphy; Chronostratigraphy; Correlation; Facies; Germany.

Abstract: 14 years after the presentation of the Stratigraphic Table of Germany 2002 (STD 2002) it is now replaced by the updated Stratigraphic Table of Germany 2016 (STD 2016). Explanations and – where needed – corrections are noted according to the various regions shown in the columns of the table. New age determinations, facies assignments and tectonic units (nappes) are given. Relations to international stratigraphic subdivisions, age determinations and respective tables are discussed.

In: Zeitschrift der Deutschen Gesellschaft für Geowissenschaften; vol. 168, n° 4, 2017, p. 447- 463 .

SEDIMENTOLOGIE

20: Prediction of sediment yield at storm period in Northwest Algeria. MADANI CHERIF H., KHANCHOUL K., BOUANANI A. , TERFOUS A.

Keywords: Erosion; Suspended sediment; Hysteresis; Water discharge; Concentration; Algeria.

Abstract: This paper studies the hydrodynamics and variability of stream flow and sediment yield in Wadi El Hammam, located in the semi-arid region of Algeria. In this location, hysteresis effects are obvious especially during high discharge periods. The sediment concentration and load maxima go several months before discharge maxima, while decreased sediment concentrations are noticed during the discharge peaks. In order to explain these phenomena, we have adopted a methodology that consists of finding a simple regression model capable of explaining the sediment load as a function of the water discharge measured at gauging stations of three rivers at various scales, e.g., annual and seasonal. Suspended sediment concentrations are measured during a 22 year period (1986/1987-2007/2008). The results have shown that the power model explains the greatest part of the variance (80 %). The changes in sediment availability result in socalled hysteresis effects. In this work, we have described different loops: clockwise or positive hysteresis loops and anti- or counter-clockwise hysteresis loops. The analysis of the seasonal sediment yields has shown that the autumn season contributes a large proportion of the annual sediment yield (62%).

In: Arabian Journal of Geosciences; vol. 10, n° 9, 2017, 198– 17 p.

21 : Dynamique des environnements crétacés (Cénomano-Turonien) de la plateforme néritique, le cas du Rocher de Constantine-Djebel Kellal (Nord-Est de l'Algérie). LAZIZ O., BENABBAS CH., BOULARAK M. , BOULVAINF.

Mots-clés: Néritique; Faciès; Microfaciès; Diagenèse; Djebel Kellal; Rocher de Constantine; Algérie.

Résumé : Les massifs du Rocher de Constantine-Djebel Kellal, constituent l'un des affleurements du Crétacé supérieur (Cénomanien-Turonien) observés dans la région de Constantine. Ces formations essentiellement néritiques montrent des paléo-environnements de rampe. La transgression cénomanienne a enregistré l'installation d'un édifice récifal représenté essentiellement par des packstones bioclastiques, des floatstones à Rudistes et des grainstones à Echinodermes. Au Turonien, une régression modérée a induit la mise en place de faciès proximaux, en débutant par des wackestones à Foraminifères benthiques et Ostracodes (milieu très protégé), des grainstones à grands Foraminifères benthiques et oncoïdes (milieu très proche du platier récifal) et se termine par des mudstones dolomitiques, des wackestones à calcisphères et des microbrèches (faciès supratidaux-intertidaux).

In : Mémoire du Serv. Géol. Algérie; n°20, 2018, p. 93-106.

22 : Le Dévonien inférieur de l'Ahnet occidental- bled El Mass (Sahara algérien), formations et environnements. MOFREDJ I., NEDJARI A.

Mots-clés: Dévonien inférieur; Paléopédogenèses; Séquences de dépôts; Formations; Membres; Cortèges sédimentaires; Cycles eustatiques; Anneaux de Liesegang; Ahnet continental; Bled El Mass; Sahara algérien.

Résumé: Le basin de l'Ahnet (Ahnet occidental – Bled El Mass) dans le Sahara central algérien se singularise par sa complexité tectonique et son degré de structuration intense liés à sa situation. Il se localise à la junction de deux ensembles géologiques cratonisés à deux époques différentes, le Craton Ouest Africain stable depuis la fin de l'orogenèse éburnéenne (2000 Ma) et la chaîne mobile du Hoggar, résultant de l'orogénèse panafricaine et, régulièrement sollicitée en liaison avec la cinématique des plaques.

Nous avons revisité le Dévonien inférieur de cette région et de découpage basé sur la lithologie. Celui que nous proposons fait appel aux discontinuités, expressions d'évènements majeurs dans l'évolution géodynamique. Ce sont, dans ce cas des paléopédogenèses.

Cette nouvelle approche, d'une part, discrimine le Dévonien inférieur de la partie occidentale du bassin de l'Ahnet en quatre formations notées FI, FII, FIII et FIV et permet, d'autre part, de reconstituer leur paléo-environnements de dépôt.

En l'absence de datations de ces formations et par analogie avec les ensembles similaires des régions de l'Ougarta et de Reggane, nou proposons les âges suivants:

- lochkovien pour les formations FI et FII;
- praguien pour la formation F III;
- et, Emsien pour la formation F IV.

En termes de stratigraphie séquentielle, deux cycles eustatiques d'ordre 2 ont été définis. Chaque cycle comprend deux cycles eustatiques de troisième ordre, notés pour chaque cycle 1, 2, 3 et 4. Les limites de séquences définies dans l'Ahnet occidental sont de type 1 et sont représentées par des niveaux paléosols à ferruginisations en anneaux de Liesegang.

In: Mémoire du Serv. Géol. Algérie; n°20, 2018, p. 71-91.

GEOLOGIE REGIONALE-CARTES

23: Web information monitoring and crowdsourcing for promoting and enhancing the Algerian geoheritage. ANNAD O., BENDAOUD A., GORIA S.

Keywords: Geoheritage; Web information monitoring; Crowdsourcing; Games with a purpose; Information retrieval; Algeria.

Abstract: The documentation and management of information concerning geological sites are important activities in all the steps of the geoheritage conservation and its day-to-day management. This documentation is mostly available on the web; it includes varied types of data such as pictures, scientific publications, news, and blog articles. In order to ensure the efficient management of the geoheritage resources, scientists and people involved in the promotion of the geoheritage and geotourism should have access to this documentation and kept updated of the most recent and relevant information. In this study, we propose the development of a web information monitoring system that automates the search and the collection of different types of documents related to the Algerian geosites available on the web. It is designed as a tool that continuously browses the web using the most popular search engines and then disseminates the results to the users through periodic newsletters. This proposed system will also serve to chronologically organize all the pictures of geosites gathered from the web and thus in order to study the evolution of Algerian geosites over time. For this purpose, we use one of the crowdsourcing methods in the field of knowledge management that is games with a purpose (GWAP). The idea there is to involve people in sorting pictures of geosites through a playful interface. The results obtained show that this system is a valuable tool that can assist geoscientists and decision makers in enhancing the geoheritage.

In: Arabian Journal of Geosciences; vol. 10, n° 13, 2017, 276– 15 p.

24: Using free/libre and open source software in the geological sciences. MADER D., SCHENK B.

Keywords: Free software; Open source software; Linux; Geological sciences.

Abstract: In the geological sciences, as in any other academic field, computers and software aided work are essential tools. Although free and open source software is largely used in academic institutions for several purposes it is not yet state-of-the-art for the every-day usage. The usage of free and open source software is, besides the freedom of its ease of use, distribution, and modification, also recommended due to the increasing financial burden. There are many suited and effective alternative free software applications to the most common used proprietary commercial ones. Many common work steps can even be done entirely with the free operating system Linux. A selection of free software applications is compiled which are useful for geoscientific data evaluation and presentation. The provided information aims to lower the threshold of reservations against a potential migration and gives an overview about currently available alternative software useful in the geological sciences.

In: Austrian Journal of Earth Sciences; vol. 110, n° 1, 2017, p. 142-161.

25 : Beau (Le) Livre de la Terre. De la formation du système solaire à nos jours. WEVER DE P., BUONCRISTIANI J.-F.

Mots-clés: Géologie; Histoire de la Terre .

Résumé: De la violence des premiers temps géologiques au foisonnement de la vie et à l'apparition de l'homme, cette nouvelle édition actualisée retrace 200 grandes étapes de l'histoire de la Terre.

- Chaque événement est expliqué et illustré par une magnifique image.
- Les plus grands savants sont présents: retrouvez Georges Cuvier, Charles Darwin; ou encore Alfred Wegener

In: Ed. Dunod ; 2017, 413 p.

26: Mapping and discriminating the Pan-African granitoids in the Hoggar (Southern Algeria) using Landsat 7 ETM+ data and airborne geophysics. ZERROUK S., BENDAOUD A., HAMOUDI M., LIEGEOIS J.P., BOUBEKRI H., BEN EL KHAZNADJI R.

Keywords: Granitoids; Landsat 7 ETM+; Airborne geophysics; In Tedeini-Iskel-Tefedest-Laouni terranes; Hoggar; Algeria; Pan-African.

Abstract: This study presents a multidisciplinary approach to discriminate and map different types and generations of Pan-African granitoids in the Hoggar, Southern Algeria, using remote sensing and airborne geophysics in close correlation with previous works and established geological maps. RGB (red, green, blue) combinations of band ratios; principal component analysis (PCA) and image classification for Landsat 7 ETM+ (enhanced thematic mapper plus), allow spatial discrimination and mapping of granitoid rocks of the studied area (200*350 km). This area extend over four contrasted Pan-African terranes (In Tedeini, Iskel, Tefedest and Laouni terranes, the two latter belong to the LATEA (Laouni-Azroun-Fad-Tefedest-Egéré-Aleksod-Assodé-Issalane) metacraton. The airborne magnetic intensity provides a wide range of responses from high values (youngest granitoids) to low values (volcano-sedimentary and gneissic country-rocks). Radiometric data, displaying radioelements concentration, discriminate efficiently the late alkaline granitoids (high values), the calk-alkaline granitoids (intermediate values) and the tonalite-trondhjemite-granodiorite series (low values). This study led to the establishment of a more accurate geological map where the geochemical characteristics of the Pan-African granitoids are determined, including plutons not yet studied, especially in the poorly known In Tedeini terrane, and brings new constraints for the geodynamic development of the Tuareg shield, which includes the Hoggar.

In: Journal of African Earth Sciences; vol. 127, 2017, p. 146-158.

PALEONTOLOGIE

27 : Brachiopodes toarciens du Haut-Atlas central (Maroc). Implications biostratigraphiques et paléobiogéographiques. ALMERAS Y., FAURE PH., COUGNON M.

Mots-clés: Toarcien; Brachiopodes; Biostratigraphie; Paléobiogéographie; Téthys; Maroc; Algérie.

Résumé: D'abondantes faunes d'Ammonites et de Brachiopodes collectées sur de nombreuses coupes le long du « transect d'Amellago » (Haut Atlas central, Maroc) ont permis d'établir une chronostratigraphie et de dater les formations et cycles sédimentaires (Pierre et *al*, 2010). Les Bachiopodes toarciens de ce secteur sont , ici , décrits et figurés pour la première fois, avec l'exposé des implications biostratigraphiques et paléobiogéographiques résultant de leur présence. L'extension verticale des brachiopodes s'intègre parfaitement dans la biozonation établie dans le domaine ouest-téthysien. Malgré leur appartenance à la marge sud-téthysienne de l'Afrique, les Brachiopodes rencontrés correspondent pour la plupart aux espèces connues par ailleurs, sur la marge nord de la Téthys occidentale, mais également en Europe nord-occidentale. Cette homogénéité des faunes dans des régions aux conditions environnementales favorables aux organismes benthiques que sont les Brachiopodes, pourrait ne pas résulter obligatoirement des déplacements des peuplements le long des voies de communication paléogéographique, le phénomène de vicariance n'étant pas exclus.

In: Bull. Soc. Hist. Nat Toulouse; t. 153, 2017, p. 47-66.

28 : Mise en évidence d'un Albien marin à Céphalopodes dans la région de Tiaret (Algérie nord-occidentale): nouvelles données paléontologiques, implications biostratigraphiques et paléogéographiques. BOUALEM N., BENHAMOU M.

Mots-clés : Albien supérieur ; Ammonites; Formation de Mcharref; Tiaret; Algérie.

Résumé : Dans la localité de Mcharref (Tiaret, Algérie nord-occidentale) un nouveau gisement fossilifère à céphalopodes d'âge albien supérieur (Crétacé inférieur) est mis en évidence dans la « formation de Mcharref ». Il s'agit de marno-calcaires contenant une riche faune de Bivalves/Huîtres, Echinides, Gastéropodes, Ostracodes, Foraminifères benthiques et planctoniques. Les Céphalopodes se trouvent dans le membre inférieur (niveau à Ammonites, n° 6). L'étude des Ammonites a permis d'établir une attribution biostratigraphique précise. La zone à *Mortoniceras pricei* est mise en évidence grâce à la détermination d'un *Elobiceras* (*Craginites*) sp. aff. *Newtoni* Spath, 1925. Une interprétation paléoenvironnementale et paléogéographique est proposée grâce à l'étude des différents faciès présents dans cette formation.

In: Revue de Paléobiologie (Genève); vol. 36, n° 2, 2017, p. 433-445.

29 : Le corail et le crocodile. Biostratigraphie du Gourara. Quelques sites et collections. CHIKHI-AOUIMEUR F.

Mots-clés: Fossiles; Collections; Biostratigraphie; Géopatrimoine; Gourara; Timimoun ; Algérie.

Résumé: Les travaux de stratigraphie portant sur la région de Timimoun révèlent deux grands centres d'intérêt: l'un concerne la limite Dévonien-Carbonifère, l'autre porte sur les faunes de vertébrés du Continental Intercalaire. Une étude documentaire allant des premiers travaux sur le Gourara (Flamand, 1901; Menchikoff, 1935; Meyendorff, 1938 a; 1938 b et 1939) jusqu'aux travaux les plus récents (Legrand-Blain, 2005 et 2007; Korn et *al.* 2010; Aretz, 2011), révèle les particularités et l'intérêt de cette région qui, en plus de son intérêt touristique, possède un intérêt paléontologique certain avec ses nombreuses localités-types. En effet, plus de 60 espèces ont été définies pour la première fois dans son périmètre. Malheureusement, aucune mesure n'est prise pour protéger cette richesse contre le pillage constaté sur le terrain. Les fossiles sont devenus une marchandise et les gisements sont menacés de disparition.

In: Mémoire du Serv. Géol. Algérie; n°20, 2018, p. 53-69.

30 : Ammonites du Jurassique inférieur (Hettangien, Sinémurien, Pliensbachien) d'Afrique du Nord (Algérie, Maroc et Tunisie). Atlas d'identification des espèces. DOMMERGUES J.-L., MEISTER CH.

Mots-clés : Ammonites; Jurassique inférieur; Taxonomie ; Biostratigraphie; Biochronologie; Paléobiogéographie; Synthèse régionale; Algérie; Maroc; Tunisie; Afrique du Nord.

Résumé : Cet atlas d'identification des Ammonites du Jurassique inférieur d'Afrique du Nord analyse 241 taxons replacés dans leurs contextes biochronologiques et paléogéographiques. Il s'agit d'une révision critique et exhaustive des faunes illustrées dans plus de 54 études paléontologiques. Une nouvelle espèce *Parasteroceras beniderkouli* sp. nov. y est également décrite. La zone d'étude, d'une superficie d'environ 680 000 km^2 , couvre les trois pays du Maghreb (Maroc, Algérie et Tunisie). Elle est divisée en 13 secteurs correspondant aux terrains autochtones et sub-autochtones de la marge septentrionale de la plaque africaine et au segment nord-africain des chaînes alpines péri-méditerranéennes. La période considérée correspond aux trois premiers étages du Jurassique (Hettangien, Sinémurien et Pliensbachien) et couvre un peu moins de 20 millions d'années. Durant cet épisode, la biodiversité marine, en particulier pour les Ammonites, connaît à l'échelle mondiale une spectaculaire phase de rediversification qui fait suite à la crise majeure de la limite Trias-Jurassique. En Afrique du Nord, les faunes d'Ammonites sont suffisamment diversifiées et leurs successions suffisamment continues pour reconnaître les 14 chronozones standards de l'Hettangien, du Sinémurien et du Pliensbachien qui vont ainsi servir de support à l'analyse biochronologique. Afin de faciliter la lecture, un tableau propose des corrélations avec les différentes zonations utilisées par certains auteurs dans cette région.

Le domaine nord-africain fait partie des confins occidentaux de la Téthys et se situe sue la marge sud-téthysienne. Si l'on note une différenciation paléogéographique entre les faunes d'Ammonites d'affinités téthysiennes et euroboréales qui se renforce au cours du temps et qui atteint son maximum au Pliensbachien, la présence de quelques taxons nord-ouest européens reste assez difficile à interpréter. Ainsi, une voie de transit via un cheminement « pré-atlantique » impliquant peut-être le bassin lusitanien est à considérer.

In : Revue de Paléobiologie (Genève); vol. 36, n° 2, 2017, p. 189-367.

31 : Middle Eocene echinoids from El Sheikh Fadl-Ras Gharib stretch, Eastern desert, Egypt: systematics, stratigraphy, palaeobiogeography. ELETTAAR A.A.

Keywords: Middle Eocene; Echinoids; Stratigraphy; Paleobiogeography; Mokattamian stage; Maghagha area; El Sheikh Fadl-Ras Gharib stretch; Egypt; North Africa.

Abstract: Twenty-two echinoid species (5 regular and 17 irregular) belonging to 14 genera, 10 families, 5 orders, and 3 subclasses are identified from the Middle Eocene succession cropping out in El Sheikh Fadl-Ras Gharib stretch, Eastern desert. The echinoid fauna studied herein came from four sections: Gebel El Mehasham, South Gebel El Mehasham ,

Gebel El Mereir, and Gebel Qarara sections. The studied succession consists of three formations, from base to top Muweilih, Midawara, and Sath El Hadid, spanning the Middle Eocene (Lutetian and Bartonian), Lower-Middle Mokattamian (levels MK3 to MK6). The highest species diversity is recorded in the Midawara formation (21 species), while the Muweilih formation is barren of echinoid species. Four species are recorded for the first time in the studied area : *Echinolampas cf . bastai* Elattaar and Strougo 2001; Schizaster isidis Stefanini Boll. Soc. Geol. Ita. 38 :39-63, 1919; *Gillechinus humei* (Fourtau 1908); and *Eupatagus lefebvrei* (de Loriol Memoires de la Société de Physique et d'Histoire Naturelle de Genève 27 :58-148, 1880). One species consider to be new, *Schizaster sp*. (n.sp). Thirteen species are endemic to Egypt, and nine are common elsewhere in the world, in some countries of Europe, Africa, and Asia. Predation and malformation in growth are observed in two species: *Schizaster humei* Fourtau Mémoires de l'Institut Egyptien 6(2) :93-175, 1909b and *Eupatagus cossmanni* (Lambert Mém. Soc. Géol. Fr., Paléont. 9 :1-57, 1902) as a shallow infaunal species. All the identified echinoid fauna herein has been examined and systematically described with the aim to know their stratigraphic and paleogeographic distribution.

In : Arabian Journal of Geosciences; vol. 11, n° 12, 2018, 303-33 p.

32: Ostracod provincialism and migration as a response to movements of earth's plates: Cretaceous-Paleogene ostracods of West Africa, North Africa and the Middle East. ELEWA A.M.T.

Keywords: Ostracod provincialism and migration; Tectonics; Cretaceous-Paleogene; Middle-East; West Africa; North Africa.

Abstract: This paper documents the Cretaceous-Paleogene ostracods response as the continental plates tend to show divergence. For example, in the intervals from the Early to Late Cretaceous when the South American plate tended to exhibit divergent movement westward from the African plate, the migration of ostracods show westward trend from Northeast Africa to West Africa; whereas, the divergence of the Indian and the Australian plates as well as the Antarctic plate from the African and the Eurasian plates, and Arabia is accompanied with ostracod migration southward. Another example from the Maastrichtian-Eocene ostracods of West Africa, where ostracods exhibit esat-west migration (despite the migration of epineritic ostracods in both directions; east-west and vice-versa) towards the North American and South American plates. These trends of migration towards the deep oceans (Atlantic and Indian oceans of present time) indicate the tendency of ostracods of these geologic times towards endemism in the deep oceans resulted from seafloor spreading during the divergence of the continental plates. On the other hand, the paleoenvironmental changes should also have significant effect on these trends of migration.

In: Journal of African Earth Sciences; vol. 134, 2017, p. 92-105.

33: Présence de l'ammonite téthysienne *Alocolytoceras ophioneum* (Benecke, 1865) (Psiloceratacae, Lytoceratidae) dans le Toarcien supérieur des Grands-Causses (Hérault, France). FAURE PH., GUIBBERT B.

Mots-clés: Ammonite; Toarcien; Aalénien; Paléobiogéographie; *Alocolytoceras ophioneum*; Lytoceratidae; Grands-Causses; France; Algérie.

Résumé: Un exemplaire de l'ammonite *Alocolytoceras ophioneum* (Benecke, 1865) (Lytoceratidae) est identifié et décrit dans le Toarcien supérieur, zone à *Aalensis*, de la bordure méridionale des Grands-Causses (Lauroux, Hérault, France). Il s'agit de la première identification de ce taxon téthysien sur la bordure méridionale des plate-formes nord-ouest européennes. Nous discutons ensuite de l'âge et de la répartition paléogéographique de cette ammonite peu connue.

In: Bull. Soc. Hist. Nat Toulouse; t. 153, 2017, p. 85-93.

34: Oxfordian brachiopods from the Saïda and Frenda mountains (Tlemcenian domain, North-Western Algerian). HALAMSKI A.T., CHERIF A.

Keywords: Brachiopoda; Jurassic; Systematics; Palaeoecology; Stratigraphy; Atlas mountains; Algeria.

Abstract: Five brachiopod species are reported from two Middle to Upper Oxfordian (Late Jurassic) outcrops, situated in the Saïda and Frenda mountains (Tlemcenian domain, North-Western Algeria) and belonging to the heterochronous (Callovian to Oxfordian, locally to the Kimmeridgian) Argiles de Saïda Formation (Saïda Clay Formation). The Upper Oxfordian (probably *Dichotomoceras bifurcates* zone) outcrop a yielded *Dictyothyris* kurri and Loboidothyridoidea indet. The Middle Oxfordian (*Liosphinctes plicatilis* zone, *Cardioceras vertebrale* subzone) outcrop B yielded Monticlarella rollieri, *Karadagithyris boullierae* sp. n., and *Zittelina* sp.; this is the first report of the last-mentioned genus from Africa. Karadagithyris boullierae sp. n. is a link between previously known Bajocian to Bathonian (Callovian?) *Karadagithyris* s.s. and Tithonian to Lower Cretaceous species, formerly segregated as *Svaljavithyris*; the latter is considered herein as synonym of Karadagithyris. It is characterised by a plano-uniplicate anterior commissure and a suberect beak. The adult loop of zittelina is confirmed as bilacunar (kingeniform) and not diploform (campagiform). The bulk of the assemblages

comprises small ad either smooth or finely ornamented species and thus represents a low-energy environment. The lack of modern revisions of the reported species in their type areas is the reason why only *Dictyothyris kurri* may be used as an index species for the middle to Late Oxfordian.

In: Annales Societatis Geologorum Poloniae; vol. 87, n° 2, 2017, p. 141-156.

35 : Nouveaux repères de restes de vertébrés et précisions biostratigraphiques dans le « Mio-Plio-Quaternaire » des Hautes-plaines Constantinoises (NE Algérien). MARMI R., HAMACHI R., YAHIAOUI A.

Mots-clés: Mio-Plio-Quaternaire; Vertébrés; Biostratigraphie; Hautes Plaines Constantinoises; Algérie Nord-orientale.

Résumé: Les Hautes Plaines Constantinoises (HPC) appartiennent aux zones externes de la chaîne alpine d'Algérie orientale et se caractérisent par une série sédimentaire mio-plioquaternaire discordante sur les formations antérieures. Cependant, les datations avancées par les anciens auteurs sont controversées et par consequence, une révision biostratigraphique s'impose. Récemment, nous avons récolté, dans les environs de Constantine, de nombreux restes de vertébrés fossiles (Proboscidiens, Bovidés, Hipparions, etc.) associés à des dépôts fluvio-lacustres. Nous avons pu mettre en évidence, à travers la région d'étude, trois niveaux repères soulignant des discontinuités liées respectivement au (i) Tortonien supérieur (D1), (ii) Pliocène inférieur (D2) et (iii) Quaternaire basal (D3). Ces dernières coïncident avec les épisodes tectoniques compressifs reconnus dans le Constantinois, particulièrement, la dernière qui a été mise en évidence, par Marmi et Guiraud (2006), dans le Môle Constantinois.

Elles sont souvent soulignées par des niveaux conglomératiques et/ou des discordances angulaires. En se basant sur ces repères et sur la corrélation lithostratigraphique des formations géologiques en question, nous avons recalé les différents niveaux biostratigraphiques ayant fait l'objet de datations controversées.

Nos investigations sur les vertébrés fossiles, associés aux formations du Néogène à travers le Constantinois, se poursuivent et contribueraient certainement à une meilleure caractérisation biostratigraphique et paléo-environnementale de ces dépôts.

In: Bull. Serv. Géol. Algérie; vol. 28, n° 1-2, 2018, p. 3-16.

36: Dinosaur trackways from the early Late Cretaceous of Western Cameroon. MARTIN J.E., MENKEM E.F., DJOMENI A.

Keywords: Dinosaur footprints; Cretaceous; Benue trough; Paleobiogeography; Cameroon; African continent.

Abstract: Dinosaur trackways have rarely been reported in Cretaceous strata across the African continent. To the exception of ichnological occurrences in Morocco, Tunisia, Niger and Cameroon, our knowledge on the composition of Cretaceous dinosaur faunas mostly relies on skeletal evidence. For the first time, we document several dinosaur trackways from the Cretaceous of the Mamfe basin in Western Cameroon. Small and medium-size tridactyl footprints as well as numerous large circular footprints are present on a single horizon showing mudcracks and ripple marks. The age of the locality is considered Cenomanian-Turonian and if confirmed, this ichnological assemblage could be younger than the dinosaur footprints reported from northern Cameroon, and coeval with or younger than skeletal remains reported from the Saharan region. These trackways were left in an adjacent subsiding basin along the southern shore of the BenueTrough during a time of high-sea stand when the Trans-Saharan seaway was already disconnecting West Africa from the rest of the continent. We predict that other similar track sites may be occurring along the margin of the Benue Trough and may eventually permit to test hypotheses related to provincialism among African dinosaur faunas.

In: Journal of African Earth Sciences; vol. 134, 2017, p. 213-221.

37: *Camelus thomasi* Pomel, 1893 from the Pleistocene type-locality Tighennif (Algeria). Comparisons with modern Camelus. MARTINI P., GERAADS D.

Keywords: Mammalia; Camelidae; Pleistocene; Morphometrics; Tighennif; Algeria.

Abstract: We describe here the whole collection of Camelus thomasi Pomel, 1893 from the Pleistocene type-locality Tighennif (Ternifine) in Algeria. Detailed morphological and metric comparisons with the two species of modern *Camelus* Linnaeus, 1758, *C. bactrianus* Linnaeus, 1758 and *C. dromedarius* Linnaeus, 1758, show that it is clearly distinct from both of them. It is mainly characterized by pachyostosis especially marked in the mandible, a size slightly greater

than modern forms, broad molars with strong styles, and several unique cranial features. The species seems restricted to the terminal Early Pleistocene and is not definitely known outside Northwestern Africa. A phylogenetic analysis is premature, but C. thomasi does not appear to be particularly close to either modern species, and there is no support to regard it as an ancestor of the dromedary.

In: Geodiversitas; vol. 40, n° 1-5, 2018, p. 115-134.

38 : Révision des Equidés (Mammalia, Perissodactyla) du site pléistocène moyen du lac Karâr (Tlemcen, Algérie). SAM Y.

Mots-clés: Perissodactyla; Equidés; Ane sauvage; Lac Karâr ; Algérie; Afrique du Nord.

Résumé: L'étude biométrique des équidés du lac Karâr (composés exclusivement de matériel dentaire) montre qu'ils appartiennent (en majorité) très probablement à l'âne sauvage fossile (*Equus africanus* Heuglin & Fitzinger, 1866) contrairement à l'étude descriptive de Boule (1900) qui les a attribué en totalité à l'espèce fossile et zébrine Equus mauritanicus Pomel, 1897 et comme évoqué dans le travail synthétique de Churcher & Richardson (1978). Ce travail remet d'actualité la question toujours mal connue de la date et du lieu d'apparition des ânes en Afrique. En effet, en Afrique du Nord-Ouest (Maghreb) tout du moins, la plupart des ânes fossiles identifiés comme tels et connus sous le nom de l'âne de l'Atlas (Equus atlanticus Thomas, 1884 ; Equus melkiensis Bagtache, Hajouis & Eisenmann, 1984) proviennent de sites datant du Pléistocène supérieur ou de périodes plus résentes (Romer 1928, 1935 ; Churcher & Richardson 1978; Bagtache & Hadjouis 1983; Bagtache et *al.* 1984 ; Eisenmann 1986, 1995; Zouhri et *al*. 1997) tandis que le lac Karâr est l'un des rares gisements potentiellement du Pléistocène moyen à avoir livré suffisamment de restes dentaires pouvant appartenir à cette espèce, d'où l'importance d'une étude biomoléculaire et d'une datation radioactive de ce matériel. L'équidé du lac Karâr pourrait donc être le représentant asinien du Pléistocène moyen qui manquait jusqu'ici sachant que le Pléistocène inférieur est symbolisé par Equus tabeti Arambourg, 1970, espèce dont le statut spécifique, quoique relativement ambigu (Arambourg ,1970), pourrait avoir des relations phylogénétiques avec l'âne de l'atlas (Hadjouis & Le Bihan 2013). Enfin, la présence dans l'échantillon de l'espèce zèbrine Equus mauritanicus n'est certainement possible que pour que deux molaires inférieures intermédiaires.

In : Geodiversitas; vol. 40, n° 6-11, 2018, p. 171-182.

39 : Ostracod assemblages from the uppermost Pliensbachian and Lower Toarcian of the Traras mountains (Tlemcen domain, North Algeria). SOULIMANE C., REOLID M., MAROK A.

Keywords: T-OAE; Microfossils; Biotic changes ; Traras Mountains; Tlemcen; North Algeria.

Abstract: This work presents a taxonomic study of the Upper Pliensbachian-Lower Toarcian ostracods from the Traras Mountains situated in Northwestern of Algeria. The ostracod fauna comprises 8 families, 11 genera and 20 species. Important changes in the composition of the ostracod assemblages have been recorded related to the Pliensbachian-Toarcian boundary and the *Polymorphum-Levisoni* zonal boundary (the biotic crisis related to the Toarcian Oceanic Anoxic Event). This turnover is denoted by the uppermost Pliensbachian assemblages dominated by the families Healdiidae and Cytherellidae to the upper part of Levisoni zone with the assemblages dominated by the families Protocytheridae and Polycopidae. Ten species of ostracods are recognised for the first time from the Lower Toarcian of the North Gondwana palaeomargin (*Bairdia kempfi*, *Bairdiacypris dorisae*, *B. triangularis*, *Ektyphocythere bizoni*, *Ogmoconcha convexa*, *Paracypris* sp. and *Polycope cincinnata*). The comparison with other regions (intrafamilial comparison and qualitative comparison) reveals close relationships between the location of the basins and their taxonomic compositions.

In : Arabian Journal of Geosciences; vol. 10, n° 18, 2017, 393-24 p.

PETROLOGIE

40 : Contribution à l'étude des séries volcaniques et volcano-sédimentaires du massif de Sidi El Medjni (Dellys-Nord de l'Algérie): pétrographie, mode de mise en place et contexte géodynamique. BAGDI S., NEDJARI A.

Mots-clés: Coulées volcaniques; Dépôts volcano-sédimentaires; Pétrographie; Bassins d'arrière-arc; Géodynamique; Sidi El Medjni; Dellys; Marge nord-algérienne.

Résumé: Un volcanisme miocène longe la côte dellysienne. Il forme des falaises abruptes. C'est le cas du Massif de la zone de Sidi El Medjni. Son étude a montré la succession de plusieurs coulées volcaniques dont les aspects sont variables mais avec des compositions minérales proches. Elles sont séparées par des assises volcano-sédimentaires mises en place dans un environnement de dépôts qui change et évolue dans le temps. Tout cet ensemble s'intercale dans un sédiment marneux de type molasse.

Cette organisation semble être celle d'un bassin d'arrière-arc mobile, dont la marge sud évoluait après chaque émission volcanique comme une marge passive.

In : Mémoire du Serv. Géol. Algérie; n°20, 2018, p. 129-138.

41: Ternary feldspar thermometry of Paleoproterozoic granulites from In-Ouzzal terrane (Western Hoggar, southern Algeria). BENBATTA A., BENDAOUD A., CENKI-TOK B.

Keywords: Feldspar thermometry; UHT metamorphism; Paleoproterozoic; In Ouzzal terrane; Hoggar; Algeria.

Abstract: The In Ouzzal terrane in Western Hoggar (Southern Algeria) preserves evidence of ultrahigh temperature (UHT) crustal metamorphism. It consists in Archean crustal units, composed of orthogneissic domes and greenstone belts, strongly remobilized during the Paleoproterozoic orogeny which was recognized as an UHT event (peak T> 1000 °C and P9-12 kbar). This metamorphism was essentially defined locally in Al-Mg granulites, Al-Fe granulites and quartzites outcropping in the Northern part of the In Ouzzal terrane (IOT).

In order to test and verify the regional spread of the UHT metamorphism in this terrane, ternary feldspar thermometry on varied rock types (metanorite, granulite Al-Mg and orthogneiss) and samples that crop out in different zones of the In Ouzzal terrane. These rocks contain either perthitic, antiperthitic or mesoperthitic parageneses. Ternary feldspars used in this study have clearly a metamorphic origin. The obtained results combined with previous works show that this UHT metamorphism (>900 °C) affected the whole In Ouzzal crustal block. This is of major importance as for future discussion on the geodynamic context responsible for this regional UHT metamorphism.

In: Journal of African Earth Sciences; vol. 127, 2017, p. 51-61.

42: Northeastern extension of Neogene magmatism in Africa: evidence from the Zitouna rhyolite, Algeria. DAIFM., TOUBAL A.

Keywords: Rhyolite; Post-Serravallian; S-type granites; Peraluminous; Zitouna; Algeria.

Abstract: The Zitouna rhyolite is the eastern most representative of the Neogene magmatism in the Northeast of Algeria. It is composed of two intrusive rhyolitic apexes: the first outcrop is poorly known and not dated; the second one is greater, and not previously described. It is a well-differentiated rock that does not exceed 12 Ma (Post-Serravallian). Geochemical data show that it belongs to S-type granites with a high peraluminous character corroborating a crustal protolith. The Zitouna rhyolite is considered as the continuation of other neighbouring magmatic episodes and can be related to the late Neogene tectono-magmatic evolution of northeast Africa.

In: Trabajos de Geologia; n° 35, 2015, p. 29-40.

43 : Petrology of lower-middle Miocene Zoumi flysch Fm. (Mesorif sub-domain, Rif belt, Morocco): first evidence of mixed mode provenance and geodynamic setting. EL MOURABET M., BARAKAT A., RAIS J.

Keywords: Trace elements; REE; Major oxides; Provenance; Geodynamic setting; Rif belt; Morocco; Algeria.

Abstract: The Zoumi Basin was generated in a collisional tectonic setting during the Lower-Middle Miocene. The syn-orogenic flysch deposits of the Basin have been well investigated by petrographic and geochemical studies to characterize the composition, source to sink routing system, and tectonic setting of the Zoumi flysch. Forty-three sandstone samples and 45 mudstone samples have been gathered from six measured stratigraphic sections. These samples have been analyzed using XRD, XRF, inductively coupled plasma-mass spectrometry (ICP-MS) for mudrocks and petrographic investigation for sandstones. The Lower-Middle Miocene Zoumi flysch is defined as sublitharenites and quartzarenites according to mineralogical content. Detrital grains are commonly subangular to subrounded, poorly sorted, and rich in quartz grains. Point counting modal analysis leads to craton interior and recycled orogen provenance with significant first-cycle sediment supply and low sedimentary recycling. Several chemical ratios (Al_2O_3/TiO_2, La/Th, Cr/Th, Th/Sc, Zr/Sc) as

well as chondrite-normalized REE patterns with flat HREE, LREE enrichment, and negative Eu anomaly suggest a dominant felsic rock sources. However, V-Ni-La*4, V-Ni-Th*10, and Th/Sc vs. Cr/Th plots do not exclude a mafic supply source nature which is evidenced by numerous ophiolitic outcrops scattered through-out the Mesorifan subdomain (Mesorifan ophiolitic suture zone).

In: Arabian Journal of Geosciences; vol. 11, n° 9, 2018, 209-30 p.

44: The Archean kalsilite-nepheline syenites of the Awsard intrusive massif (Reguibat shield, West African Craton, Morocco) and its relationship to the alkaline magmatism of Africa. HAISSEN F., CAMBESES A., MONTERO P.

Keywords: Alkaline; Syenite; Ring; Isotopic and geochemical fingerprints; Mantle-crust evolution; Africa.

Abstract: More than 40% of the known alkaline complexes are reported from Africa. Most are ring complexes composed of syenites and associated or not, lithotypes as carbonatites, granites and mafic rocks. Radiometric dating indicates the presence of alkaline complexes with ages spanning from Precambrian to the present. In terms of outcrops, alkaline complexes are reported from cratonic zones and from belts embedded between cratonic areas. Because of the high economic potential for associated REE deposits, these alkaline complexes have received much attention from earth scientists. These studies aim mainly to constrain the role of the mantle and the crust (and the interaction between them) in the genesis of this peculiar magmatism, and also to explain the variability observed in lithotypes and geotectonic settings. Among those alkaline complexes, Precambrian occurrences are rare. Up-to-date only a few Proterozoic examples were cited in Africa. The recently studied Awsard complex in Southern Morocco is a peculiar one with a crystallization age of 2.46 Ga and an unusual rock assemblages. This paper is a first approximation to a comparison of geochemical and isotopic fingerprints of the Awsard magmatism (as the oldest one) with other known different ages African complexes from different geotectonic settings, aiming to detect if there is any evolution in this alkaline magmatism through time. A first conclusion is that magma sources for this alkaline magmatism has been probably evaluating over geological time, from parental magmas compositions close to that of primitive mantle in these early geological time to compositions holding more and more depleted mantle and continental crust components. However, to go further in this debate more modern isotopic, geochemical and geochronological data from all these complexes are needed. Nevertheless, this comparison highlighted the peculiar character of the Awsard magmatism with an isotopic composition very close to that of primitive mantle (values of $\varepsilon Nd_{(2.46Ga)}$ range from -3.5 to 1.2, Nd model ages range from ca.2.5 Ga to 3.0 Ga (the hosting TTG gneiss crystallization age)); an ultrapotassic composition ($k_2O/Na_2O>10$); the oldest crystallization age 2.46 Ga reported until the date in Africa and the unusual occurrence of kalsilite-rich syenites “synnyrites”.

In: Journal of African Earth Sciences; vol. 127, 2017, p. 16-50.

45: A historical overview of Moroccan magmatic events along northwest edge of the West African Craton. IKENNE M., SOUHASSOU M., ARAI S.

Keywords: Precambrian; Variscan; Magmatism; Morocco; West African craton; Alpine**.**

Abstract: Located along the northwestern edge of the West African craton, Morocco exhibits a wide variety of magmatic events from Archean to Quaternary. The oldest magmatic rocks belong to the Archean Reguibat shield outcrops in the Moroccan Sahara. Paleoproterozoic magmatism, known as the Anti-Atlas granitoids, is related to the Eburnean orogeny and initial cratonization of the WAC. Mesoproterozoic magmatism is represented by a small number of mafic dykes known henceforth as the Taghdout mafic volcanism. Massive Neoproterozoic magmatic activity, related to the Pan-African cycle, consists of rift-related Tonian magmatism associated with the Rodinia breakup, an Early Cryogenian convergent margin event (760-700 Ma), syn-collisional Bou-Azzer magmatism (680- 640 Ma), followed by wide–spread Ediacaran magmatism (620-555 Ma). Each magmatic episode corresponded to a different geodynamic environment and produced different types of magma.

Phanerozoic magmatism began with Early Cambrian basaltic (rift?) volcanism, which persisted during the Middle Cambrian, and into the Early Ordovician. This was succeeded by massive Late Devonian and Carboniferous, pre-Variscan tholeiitic and calc-alkaline (Central Morocco) volcanic flows in basins of the Moroccan Meseta. North of the Atlas Paleozoic transform zone, the late Carboniferous Variscan event was accompanied by the emplacement of 330-300 Ma calc-alkaline granitoids in upper crustal shear zones. Post-Variscan alkaline magmatism was associated with the opening of the Permian basins.

Mesozoic magmatism began with the huge volumes of magma emplaced around 200 Ma in the Central Atlantic magmatic province (CAMP) which was associated with the fragmentation of Pangea and the subsequent rifting of central atlantic. CAMP volcanism occurs in all structural domains of Morocco, from the Anti-Atlas to the external Rif domain with a peak activity around 199 Ma. A second Mesozoic magmatic event is represented by mafic lava flows and gabbroic intrusions in the internal Maghrebian flysch nappes as well as in the external Mesorif. This event consists of Middle-

Upper Jurassic MORB tholeiites emplaced during opening of the Alpine Tethys ocean. The Central High Atlas also records Early Cretaceous alpine Tethys magmatism associated with the aborted Atlas rift, or perhaps linked to plume activity on the edge of the WAC. Cenozoic magmatism is associated with Tertiary and Quaternary circum-Mediterranean alkaline provinces, and is characterized by an intermittent activity over 50 Ma from the Anti-Atlas to the Rif mountain along a SW-NE volcanic lineament which underlines a thinned continental lithosphere.

In: Journal of African Earth Sciences; vol. 127, 2017, p. 3-15.

46 : Metasomatism and origin of glass in the lithospheric mantle xenoliths beneath Ain Temouchent area (North-West Algeria). LAHMER M.C., SEDDIKI A., ZERKA M.

Keywords: Mantle xenoliths; Partial melting; Metasomatic process; Basaltic melt; Silicic glass; Ain Temouchent area; Algeria.

Abstract: A spinel± amphibole± feldspar bearing Iherzolites, a spinel ±amphibole ±feldspar bearing harzburgites, and a spinel ± amphibole ± phlogopite bearing wehrlites are metasomatized peridotitic mantle xenoliths from Ain Temouchent volcanic complex (North West Algeria). These xenoliths are metamorphic/deformed rocks with a strong planar fabric typical of mantle tectonites. The wehrlites are not the result of a simple model of partial melting. The spinel ± amphibole feldspar bearing harzburgites and Iherzolites exhibit asymmetric concave-shaped REE patterns. These indicate that an earlier partial melting event was followed by metasomatic processes. The wehrlites have higher REE concentrations and LREE/HREE fractionations, indicationg a sequential evolution of wehrlites from previous refractory material with melting as an addition process. This process reflects the interaction of the lithospheric mantle beneath the Ain Temouchent area with basaltic melt. Metasomatism is expressed by the formation of amphibole, phlogopite, and increased abundances of clinopyroxene at the expense of orthopyroxene, in Iherzolite and harzburgite.

In the Ain Temouchent area, metasomatizing agents are Na-alkali silicates. The similarities observed between the glasses studied in this paper, and the basaltic host rocks of the Ain Temouchent area, may suggest a common mantle source, or with chemical similarities but with relatively different evolutions pathways. The formation of glass in wehrlites from the Ain Temouchent area has an origin formed by the breakdown of amphibole or phlogopite as a result of decompressional melting and production of silica-undersaturated glasses[2]. The glass reacts with essentially orthopyroxene to produce silica-rich glasses. This study has contributed to highlighting a relationship between glass, and the processes that caused the formation of metasomatic phases.

In: Arabian Journal of Geosciences; vol. 11, n° 12, 2018, 332-16 p.

47 : Mafic dikes at Kahel Tabelbala (Daoura, Ougarta Range, South-Western Algeria): new insights into the petrology, geochemistry and mantle source characteristics. MEKKAOUI A., REMACI-BENAOUDA N., GRAÏNE-TAZEROUT KH.

Keywords : Mafic dikes; Petrology-geochemistry; Sr-Nd isotopes; Mantle plume; Kahal Tabelbala; Ougarta Range; Algeria.

Abstract: New petrological, geochemical and Sr-Nd isotopic data of the Late Triassic and Early Jurassic Kahel Tabelbala (KT) mafic dikes (South-Western Algeria) offer a unique opportunity to examine the nature of their mantle sources and their geodynamic significance. An alkaline potassic Group 1 of basaltic dikes displaying relatively high MgO, TiO_2, Cr and Ni, La/Yb_N ~ 15, coupled with low $^{87}Sr/^{86}Sri$ ~0.7037 and relatively high $\varepsilon_{Nd}(t)$ ~ +3, indicates minor olivine and clinopyroxene fractionation and the existence of a depleted mantle OIB source. Their parental magma was generated from partial melting in the garnet-iherzolite stability field. A tholeiitic Group 2 of doleritic dikes displaying low MgO, Cr and Ni contents, La/Yb_N ~5, positive Ba, Sr and Pb anomalies, the absence of a negative Nb anomaly, the absence of a negative Nb anomaly coupled with moderate $^{87}Sr/^{86}Sri$ ~ 0.7044 and low $\varepsilon_{Nd}(t)$ ~ 0 (BSE-like), indicates a contamination of a mantle-derived magma that experienced crystal fractionation of plagioclase and clinopyroxene. This second group, similar to the low-Ti tholeiitic basalts of the Central Atlantic Magmatic province (CAMP), was derived from partial melting in the peridotite source within the spinel stability field. Lower Mesozoic continental rifting could have been initiated by a heterogeneous mantle plume that supplied source components beneath Daoura, in the Ougarta range.

In : C. R. Acad. Geoscience; vol. 349, n° 5, 2017, p. 202-211.

MINERALOGIE

48: Identification and mapping of clay minerals in the region of Djebel Meni (Northwestern Algeria) using hyperspectral imaging, EO-1 hyperion sensor. ZAZI L., BOUTALEB A., GUETTOUCHE M.S.

Keywords: Hyperion; Hyperspectral; SMACC; SAM; Clay mineals; Djebel Meni; NW Algeria.

Abstract: Applied in Djebel Meni (Northwestern of Algeria), this research highlights the results obtained from the supervised classification using the spectral angle mapper (SAM) algorithm, through introducing the spectral signatures of illite, kaolinite, and montmorillonite, via Jet Propulsion Laboratory (JPL) aspectral library. These results were compared to the ones of the SAM classification, which use spectral signatures obtained by the sequential maximum angle convex cone (SMACC) endmembers extraction algorithm. This implies the ability to detect and identify any object present on the Earth's surface, whether its nature is mineral, vegetal, or human made, from hyperspectral imaging. By extracting the spectral signatures with the SMACC algorithm and matching them to the current signatures of JPL spectral library, comparing spectral signatures with another is not an easy task. Indeed, for a better comparison and a more appropriate interpretation in the use of the SAM classification, the results obtained were very relatively convincing because, regarding very strong similarities. It apperas also that the signatures extracted with SMACC occupy the same areas as those of the JPL spectral library. This method of detection and identification of any present object on the earth's surface is rather conclusive.

In: Arabian Journal of Geosciences; vol. 10, n° 11, 2017, 252-10 p.

GEOLOGIE MINIERE

49 : Controls on gold deposits in Hoggar, Tuareg shield (Southern Algeria). AISSA D.-E.,, MARIGNAC CH.

Keywords: Orogenic gold; Shear zone; Gold endowment; Hoggar shield; Algeria; Pan-African belt.

Abstract: The Hoggar shield belongs to the 3000 km-long Pan-African Trans-Saharan belt that was formed in the Neoproterozoic, between 750 and 500 Ma by continental collision between the converging West African Craton, Congo craton and Saharan metacraton. More than 600 gold occurrences have been identified by ORGM, which are confined along North-South Pan-African megashear zones stretching some hundreds of kilometres long. Until now, no global classification and mineral paragenesis characterisation have been proposed for the Hoggar's gold mineralization. In this paper, we briefly review the main gold mineralization, in order to classify them and to highlight their characteristics and controls. According to field work, spectral, microscopic and microthermometric studies, these mineralization can be globally classified asorogenic type shear zone, which can subdivided into three main sub-types according to the degree of their relationships with the major Pan-African shear zones: (i) ultramylonite-mylonite hosted including Tirek and Amesmessa, world class deposits; (ii) granite hosted, including Tekouyat occurrence (iii) volcano-sediment hosted including Tiririne and In Abbegui deposits.

All the deposits are coeval and were formed at the end of the post-collisional stage (530-520 Ma). In Hoggar, gold mineralization depend on a double control, first order giant sub-meridian shear zone control and the gold districts disposed in N40°-50°E corridors that may be interpreted as extensional. Indeed, the Hoggar gold province appears to have been controlled at all scales by the late transtensive reactivation of the Pan-African mega-shear zones, and by the correlative heat flux associated with the linear lithospheric delamination processes accompanying this reactivation; ; Which are also responsible linear lithospheric delamination processes accompanying this reactivation; which are responsible for the very late Hoggar magmatic events. At Amesmessa, gold deposition was promoted by the mixing of metamorphic fluids issued from the In Ouzzal Archean-Proterozoic basement with magmatic, basinal and meteoric-derived water. These deposits and occurrences contains variable minerals and trace elements in order of decreasing importance: Pb, Zn, Cu, Ag, Bi, W, Te, Co, Cr, Mo, Ni, Nb, Ta, U, Uf, REE, PGE.

In: Journal of African Earth Sciences; vol. 127, 2017, p. 136-145.

50: Use of Late Barremian sands from Central Tunisia in white cement clinker. ALOUI T., RHIMI L., JABLI I.

Keywords: White cement; Raw materials; Late Barremian; Sidi-Aïch formation; Ouaddada; Tunisia.

Abstract : The present work focuses on the ability of Late Barremian sands from Ouaddada mountain (Central Tunisia), to produce high-quality white cement clinker. Results indicate that these sands are particularly characterized by their

fineness of grains (mean grain-size 90-140 μm), high cleanness (sand equivalent 88-98%), extremely low coloring oxides and volatiles levels (less than 0.03 and 1.9% respectively) and high values of whiteness and lightness indices (more than 86 and 90% respectively). Studies based on bogue calculation, X-ray diffraction (XRD), burnability of raw mixes, point counting and scanning electron microscopy (SEM) with energy-dispersive X-ray spectroscopy (EDS) methods, reveal that the Late Barremian sands from Ouaddada mountain can be used in the production of white portland clinker by mixing with 70.8-75.6% of local limestones and 3.5-24.8% by weight of common Mediterranean kaolins from Guadalajar province (Central Spain), Tamazert (North-East Algeria), Sile (North-West Turkey), Sebha (South-West Libya), and Abu Zanima area (West-Cenral Sinai, Egypt). Synthesised clinkers are composed largely of alite (75-76.2%), belite (12.8-16.5%) and aluminate (7.4-8.9%) with subordinate quantities of ferite (less than 1%), slightly harder to burn and seem to be much whiter than Mediterranean ones with a whiteness index β more than 86%.

In: Arabian Journal of Geosciences; vol. 10, n° 11, 2017, 240-18 p.

51 : Particularités morphologiques et minéralogiques du gisement aurifère d' In-Abeggui (Hoggar central, Sud algérien). BOUTRIKA R., KOLLI O., AÏSSA DJ.-E., ADACHI T.

Mots-clés: Or natif; Filons de quartz à tourmaline; Stockwerk; Gabbro; Aplite; Greisen; Orogenèse panafricaine; Hoggar central; Algérie.

Résumé: Le gisement aurifère d'In-Abeggui est situé dans la partie orientale du terrane de Laouni (Hoggar Central, Sud algérien). A la différence des principaux gisements aurifères du Hoggar, In-Abeggui n'est pas lié aux méga-shear zones subméridiennes mais à une marge tectonique de terrane. Les études géologiques, tectoniques, pétrographiques et minéralogiques nous ont amené à distinguer deux types morphologiques de minéralisation aurifère : (i) grands filons de quartz à tourmaline encaissés dans un massif de gabbro-diorites et (ii) stockwerk et veinules de quartz à tourmaline encaissés dans des dykes de microgranites-aplites tardifs. L'ensemble est intégré dans un contexte de bassin volcano-sédimentaire du Néo-protérozoïque. Les minéralisations sont caractérisées par une altération hydrothermale intense tandis que l'aplite est transformée en un assemblage de quartz-muscovite (greisen).

L'association minérale rencontrée dans ce gisement comprend: quartz-tourmaline-muscovite-rutile-topaze-wolframite-molybdénite- pyrite- arsénopyrite- pyrrhotite- chalcopyrite-bismuthinite-bismuth natif-galène-sphalérite-or-calcite-dolomite et les oxydes et hydroxydes de fer. Ainsi, In-Abeggui se particularise par la présence de topaze molybdénite wolframite liés aux zones greisenisées ainsi que par une abondance anormale de rutile.

In : Bull. Serv. Géol. Algérie; vol. 28, n° 1-2, 2018, p. 17-42.

52 : Estimation des ressources d'un gisement karstique par méthodes géostatistiques: cas du gisement de fer d'Anini (Nord-Est algérien). HALIMI F., MEZGHACHE H.

Mots-clés: Gisement de fer; Karst; Estimation géostatistique; Effet de trou; Coefficient de minéralisation; Anini; Sétif; Nord-Est algérien.

Résumé : L'estimation des ressources en minerai d'un gisement se fait à l'aide de plusieurs méthodes aussi bien conventionnelle que géostatistique. Le choix de la méthode dépend du type génétique et de la géométrie du gisement. Dans le cas de gisements karstiques, l'utilisation des méthodes aussi conventionnelles que géostatistiques présente des inconvénients majeurs dont il faudrait tenir compte pour optimiser les estimations. Ces méthodes ont été appliquées au gisement de fer d' Anini pour lequel une approche spécifique a été proposée.

Le gisement de Fer d'Anini est situé dans la partie nord-orientale de la chaîne alpine de l'Algérie au nord de la ville de Sétif. Il est constitué de corps de minerais de forme karstiques et lenticulaires de direction N135°. La minéralisation ferrifère est constituée essentiellement d'hématite, de goethite et d'argile ferrugineuse. Le gisement a été exploré par 72 sondages carottés (2009-2011) par l'Office National de la Recherche Géologique et Minière (ORGM).

Les échantillons de carottes ont été analysés sur Fer Total (FeT). L'estimation des ressources en fer a été faite à l'aide de méthodes conventionnelles par l'ORGM. Ces ressources ont été réestimées par méthode géostatistique de krigeage. En plus de l'anisotropie, la variographie a montré la présence d'effets de trou dans les deux principales directions d'anisotropie N135° et N45°. Les variogrammes directionnels dans ces deux directions ont été ajustés à l'aide d'un modèle sphérique de portées respectivement égales à 288m et 100m. La direction du grand axe d'anisotropie correspond à celle de la direction de la fracturation. Le grand écart entre les ressources estimées par les méthodes conventionnelles et celles obtenues par le krigeage est sûrement dû à la discontinuité de la minéralisation qui se reflète dans le variogramme par la présence d'effets de trou. Pour y remédier, il a été nécessaire d'utiliser le coefficient de minéralisation. Ceci a permis de réduire l'écart entre les deux estimations. Ainsi, pour optimiser l'estimation des ressources de minerais karstiques par méthodes géostatistiques, il est nécessaire de tenir compte du coefficient de minéralisation qui s'apparente à un coefficient de probabilité.

In : Bull. Serv. Géol. Algérie; vol. 28, n° 1-2, 2018, p. 93-113.

53 : Les minéralisations à Pb ? Zn ? (Cu, Ba et F) de la région de Kherrata (Atlas tellien, Algérie). MAZARI DJ.E., KOLLI O., BOUTALEB A.

Mots-clés: Crétacé supérieur ; Trias ; Fluorite ; Galène ; Sphalérite ; Nappe de Djemila ; Kherrata ; Algérie.

Résumé: La region de Kherrata appartient au domaine externe tellien qui est caractérisé par un empilement de nappes. Elle est connue aussi sous le nom de zone Nord-sétifienne définie par Glaçon (1967). Les nappes telliennes y sont bien exprimées notamment, la nappe de Djemila qui constitue l'unité structurale essentielle de cette zone. Elle se subdivise en deux ensembles bien distincts:

(i) un ensemble supérieur septentrional, qui forme une vaste écaille chevauchante à matériel dolomitique, calcaire, pélitique et marno-calcaire allant du Jurassique au Crétacé inférieur;
(ii) un ensemble inférieur meridional représenté essentiellement par de intercalations de marnes et de calcaires marneux rattachés au Sénonien et au Lutétien

Les contacts entre les nappes sont souvent jalonnés par une semelle de roches tectonisées appartenant au Trias. Dans cette région, existent des minéralisations qui se manifestent sous forme d'indices peu importants et encaissés, pour l'essentiel, dans les calcaires marneux du Sénonien et dans les dolomies et calcaires du Lias. Elles montrent une allure filonienne ou en amas et se répartissent en plusieurs types : (i) en amas de cuivre gris et barytine dans des dolomies liasiques, (ii) en filonnets plombifères (galène), (iii) en filonnets zincifères (sphalérite) et (iv) en filonnets fluorés (fluorite). Toutes ces veines présentent une épaisseur centimétrique et une extension hectométrique.

Il existe une expression particulière d'une minéralisation fluorée au sein de gros blocs de dolomie emballés dans le Trias qui marque le contact entre la nappe de Draa El Arba au Nord et la nappe de Djemila au Sud. Cette minéralisation se présente sous forme de poches et de petites fractures remplies de fluorite et de calcite drusique.

La répartition de ces indices obéit, à la fois, à un contrôle lithologique, illustré par la répartition préférentielle des indices minéralisés dans deux niveaux lithostratigraphiques du Crétacé supérieur et du Jurassique et, un contrôle structural défini par deux directions principales de failles: NE-SO et EO. Cette dernière est à remplissage plombifère uniquement (galène et calcite), alors que la direction NE-SO encaise à la fois une minéralisation zincifère (sphalérite) et une minéralisation fluorée (fluorite). Ces minéralisations seraient d'âge miocène à tardi-miocène.

In : Bull. Serv. Géol. Algérie; vol. 28, n° 1-2, 2018, p. 43-65.

54 : Apport de la modélisation 3D par DATAMINE dans la valorisation minière. L'Apport du SIG dans la valorisation des structures fluoritères de la mine d'Achemach (Maroc central). NASSIRI O.

Mots-clés: Métallogénie; Structure; Géologie; Ressource; Exploitation; Exploration; Edute géoéconomique; Base de données; Logiciel DATAMINE; Achemach; Maroc central.

Résumé: La Société Anonyme d'Entreprise Minières (SAMINE) est devant un souci de performance, de faisabilité et d'organisation, aujourd'hui la mine cherche à informatiser, uniformiser et stocker ces données géologiques volumineuses, qui ne cesse de s'accroitre jour après jour d'une part, et éventuelle perte d'autre part.

C'est dans cet objectif que les décideurs de la société ont songé à l'adoption d'une interface d'acquisition, de gestion et de traitement des données sous Microscoft Excel et par la suite le traitement des données sous DATAMINE. Ce logiciel est utilisé dont le but de la modélisation des données géologiques et aussi pour l'estimation des ressources et réserves en vue d'une prise de décisions convenable en terme d'exploration, d'exploitation, d'étude géoéconomique et d'étude d'optimisation.

Ce projet est un sujet d'importance et d'urgence pour la mine, il consiste à la création d'une base de données des différents ouvrages d'un ancien gisement colossal. Cette basse de données est structurée et organisée. La fiabilité et la crédibilité de la base de données est marquée par un contrôle de qualité pour qu'elle soit soumise à la validation et au traitement informatique sous DATAMINE.

Par la suite, plus de 300 coupes transversales sont créées le long des données du secteur avec un maillage régulier et serré afin de ne pas omettre les données. En se basant sur ces coupes transversales, un modèle tridimensionnel du gisement est élaboré.

L'analyse de ce modèle révèle l'existence de la structure principale, et d'une structure satellite non négligeable de point de vue teneur. En plus, ce modèle 3D permet de confirmer l'aspect structural affectant le secteur.

Pour la valorisation de ce modèle, un traitement statistique et géostatistique des données, est établi.

Suite à la grande similitude entre le secteur d'Achemach et le secteur Tlatezma sur le plan géologique, structural et géométrique des deux secteurs Achemach et Tlatezma, nous recommandons l'exploration de la zone intermédiaire entre ces deux secteurs.

In: Editions Universitaires Européennes ; 2017, 124 p.

55 : Gold deposits associated with the gabbroic rocks at Tirek area, Western Hoggar, Algeria: fluid inclusion study. SAAD W., AISSA DJ.E., WATANABE K., TAGUCHI S.

Keywords: Shear zone; Fluid inclusions; Tirek gold deposit; Hoggar; Algeria.
Abstract: The Tirek gold deposit hosted in the Archean shield is one of the richest sources of mined gold for Algeria. The deposit is controlled by the East Ouzzal shear zone (EOSZ), a transcurrent N-S lithospheric fault. The EOSZ is a late Pan African dextral-ductile shear zone separating two contrasting Precambrian domains : the Archean In Ouzzal block to the west (orthogenesis with subordinate metasediments reworked and granulitized during the ca. 2Ga Eburnean event) and a middle Proterozoic block to the east involved in the ca. 600 Ma Pan-African event. The auriferous quartz veins are mainly oriented in two directions, N-S veins hosted in mylonitic rocks and NE-SW veins hosted in gabbroic or gneissic bands. The NE-SW veins contain the richest ore. Gold ore is found in a system of veins and lenticular quartz veinlets arranged in anastomosing networks. The hydrothermal alteration associated with these veins is characteristically a carbonate-sericite-albite-pyrite assemblage. Gold is the main metal of economic importance; it is disseminated in the quartz as grains or fibers along microcracks and as microscopic grains in the host rocks. Microthermometric results and Raman laser data from fluid inclusions demonstrate that the ore-forming fluids contained H_2O-$CO_2 \pm CH_4$ and were low salinity. Homogenization temperatures are commonly 250-310°C. In the Tirek deposit, the role of the shear zone that hosts the mineralization was to drain the hydrothermal fluid. Interactions between the fluid and the mafic host rocks and CO_2 also contributed to the formation of the hydrothermal gold deposit at Tirek.

In : Arabian Journal of Geosciences; vol. 11, n° 2, 2018, 26-10 p.

56 : Recherches de minéralisation d'uranium dans le bassin de Tim Mersoï (République du Niger). Une revue des guides de prospection. SANGUINETTI H., NEDJARI A., AOUAMI I., DIN CH., CAZOULAT M., TIEMOGO M., CORBIN CH.

Mots-clés: Minéralisation; Uranium; Gisement; Indice; Tim Mersoï; Niger.

Résumé : Dans le bassin de Tim Mersoï (Niger), tous les gisements d'uranium connus sont de type gréseux. Ils partagent bien des similitudes, même s'ils se sont formés à différentes périodes géologiques du Viséen tardif au sommet du Carbonifère puis du Jurassique au Crétacé avec un probable remodelage au Tertiaire. Dans cette contribution, nous présentons les grands guides de prospection que nous avons utillisés, dans les travaux d'exploration auxquels nous avons participé depuis 1976, et poursuivi à partir de 2007 avec l'arrivée de nouveaux explorateurs. Ces guides découlent d'analyses de terrain et de sondages sur la recherche des « halos de redox » susceptibles de receler des fronts de redox minéralisés.
Les gisements découvertes sont décrites d'abord en terrains connus par les travaux antérieurs pour s'achever en « sub-grass root ».
Les méthodes décrites pourraient être appliquées dans les prospections d'autres bassins sédimentaires.

In : Mémoire du Serv. Géol. Algérie; n°20, 2018, p. 157-182.

GEOCHIMIE

57 : Hoggar geochronology: a historical review of published isotopic data. BECHIRI-BENMERZOUG F., BONIN B., BECHIRI H., KHELOUI R., TALMAT-BOUZEGUELA S., BOUZID KH.

Keywords: Isotopic dating techniques; Low temperature thermochronology; Archean; Paleoproterozoic; Neoproterozoic; Paleozoic; Mesozoic; Cenozoic; High-grade; High-pressure; High-temperature metamorphisms; Granitoid batholiths; Volcanic activity; Taourirt igneous suite; Hoggar; Algeria.

Abstract : A dataset of more than 400 isotopic ages on the Hoggar shield, published from 1963 to 2017, was obtained by increasingly precise isotopic dating techniques and low temperature thermochronology. Data were arranged by eras and terranes and classified in two categories « before 1980 » and « after 1980 ». They illustrate the protracted geological history of the Hoggar shield. The first continental nuclei were formed 3.2-2.5 Ga ago during the Archean, with high-grade metamorphic and associated magmatic episodes. A second group of continental terranes was created 2.40-1.75 Ga ago during the Paleoproterozoic, with Eburnean orogenic episodes marked by reworking of older Archean terranes associated with juvenile terranes. After the 1.80-0.90 Ga long period of quiescence, the 870-540 Ma Neoproterozoic times were characterized by Pan-Afican episodes, with early overthrusting of eclogitic nappes and late strike-slip movements along north-south trending shear zones, high-grade metamorphism and anatexis, emplacement of large granitoid batholiths

followed by complexes of the Taourirt igneous suite. Cambrian hydrothermal activity evidences either a slow cooling process, or more likely discrete thermal pulses. After scarce Carboniferous mafic magmatism, the Mesozoic and the beginning of the Cenozoic constituted a period of quiescence marked by subsidence and burial after the Early Cretaceous. Low-temperature chronology records episodes of alternating subsidence and exhumation. Widespread Eocene exhumation predated volcanic activity beginning in the Late Eocene and continuing until recent times, in association with Africa-Europe convergence processes.

In : Arabian Journal of Geosciences; vol. 10, n° 16, 2017, 351-32 p.

58 : **The oceanic anoxic event 2 at Es Souabaa (Tebessa, NE Algeria): bio-events and stable isotope study.** SALMI-LAOUAR S., FERRE B., CHAABANE KH., LAOUAR R., BOYCE A.J., FALLICK A.E.

Keywords: Oceanic Anoxic Event 2; Cenomanian-Turonian boundary; Filaments; Stable isotopes; TOC; Es Souabaa; Tebessa; Algeria.

Abstract: At the southern margin of the Tethys, the Es Souabaa area recorded traces of Oceanic Anoxic Event 2 (OAE2) around the Cenomanian-Turonian boundary (C/Tb). The dark, laminated, filament-and pyrite-bearing limestones represent the typical facies of this event. In terms of sedimentary environment, these features reflect a transgressive drowning that had induced hypoxia in these sedimentary environments. Such conditions favored the deposition and preservation of organic matter of marine origin, the distribution of which was controlled by paleogeography and halokinetic tectonics at that period. The OAE2 reached a climax between the last Upper Cenomanian occurrence of *Rotalipora cushmani* and theLower Turonian occurrence of *Whiteinella praehelvetica*. Positive shift og the $\delta^{13}C$ excursion along with relatively high Total Organic Carbone (TOC) contents during OAE2 both indicate palaeo-environmental modifications enhanced by a significant change in primary marine productivity. Meanwhile, negative $\delta^{18}O$ peaks in carbonates reflect increasing temperatures. Comparison of the data from this study with those from the neighboring Kalaat Senan section (Tunisia) suggests close similarities of events, although OAE2 is much more enhanced in Algeria.

In : Arabian Journal of Geosciences; vol. 11, n° 8, 2018, 182-18 p.

59 : Géoochimie et géostatistique de l' Hauterivien inférieur et des minéralisations à Zn-Pb associées dans le gisement de Chaabet El Hamra –Bassin du Hodna-Algérie. TOUBI N-E.-H. , MEZGHACHE H .

Mots-clés: Géochimie ; Géostatistique; Zn/Pb; Chaabet El Hamra; Bassin du Hodna; Algérie.

Résumé : Les Monts du Hodna présentent un grand potentiel en Zn-Pb. Le gisement de Chaabet El Hamra, situé au sud de Sétif, en fait partie. Ce gisement a été exploré par l'Office National de la Recherche Géologique et Minière (ORGM) et est en cours d'exploitation par l'Entreprise Nationale des Produits Miniers Non Ferreux (ENOF). La minéralisation à Zn-Pb est encaissée dans l'Hauterivien inférieur.

Des échantillons prélevés dans les galeries du gisement ont été analysés par diffraction aux rayons X au Laboratoire Pétro-Minéralogie de l'ORGM-Boumerdès. Cette analyse a confirmé la composition minéralogique signalée par Pogrennoi et *al*. (1992) et Boutaleb (2001). L'étude géochimique et géostatistique a été faite sur 2044 données chimiques de carottes de sondages. La très forte variabilité des teneurs en Zn, Pb et Ag est due à une hétérogénéité des données géochimiques d'où la nécessité de procéder à une discrimination de celles-ci par faciès ou origine. La classification monovariée a permis de discriminer trois (03) sous-populations : la première correspond au fond géochimique, la deuxième et la troisième correspondent respectivement au minerai type 1 : minerai moyen et minerai type 2 : minerai riche. L'analyse en composantes principales (ACP) a confirmé le résultat précédent. Elle montre la présence de trois (03) associations, la première donne les caractéristiques géochimiques de l'Hauterivien inférieur – diagénétique – et les deux autres caractérisent les deux types de minerais qui se seraient formés tardivement par la circulation de fluides – épigénétiques. Le variogramme vertical du Zn qui a été ajusté par un modèle sphérique de portée a=4m ne montre aucun effet de trou. L'alternance des lentilles minéralisées avec le stérile dans le sens de l'épaisseur de l'Hauterivien inférieur n'est pas systématique. L'absence de l'effet de trou dans les autres variogrammes directionnels du Zn prouve que ces lentilles minéralisées sont irrégulièrement réparties dans tout le gisement. La variographie du Zn dans le plan de la couche de l'Hauterivien inférieur montre une anisotropie géométrique avec un grand axe orienté N130°, et d'autre portée de 446m et un petit axe orienté N220°, d'une portée de 86m. Les valeurs des portées correspondraient aux dimensions moyennes des lentilles minéralisées.

In : Bull. Serv. Géol. Algérie; vol. 28, n° 1-2, 2018, p. 67-92.

60 : Delineation of potential recharge area using a hybrid model, case of Djelfa Hadjia watershed. ALI RAHMANI S.E., CHIBANE B.

Keywords: Groundwater recharge; Hybrid model; Potential area of recharge; Environmental assessment; Water resources management; Djelfa Hadjia; Algeria.

Abstract : Groundwater potential map is important for environmental assessment and water resources management. In this work, a ground-water recharge potential map was established for the watershed of Oued Djelfa Hadjia in Algeria, based on new multiparameters hybrid model. The model has hyroclimatic parameters, geological settings, slope factor, and stream network density factor as inputs. The groundwater recharge estimated by the model range from 0.71 to 14 mm. The model allows delineation of potential area of recharge. The total water abstraction in Djelfa city is about of 14 hm^3 ; however, the calculated groundwater recharge is about 3 mm/year (min 0.71 mm and max 14 mm), which correspond to an average recharge volume of 3.9 hm^3 which mean that the aquifer is under over exploitation.

In : Arabian Journal of Geosciences; vol. 11, n° 9, 2018, 214-16 p.

61 : Hydrochemical and stable isotopic investigation of groundwater quality and its sustainability for irrigation in the Hammamet-Nabeul Basin, Northeastern Tunisia. BEN MOUSSA A., SALEM S.B.H., ZOUARI K., JELASSI F.

Keywords: Water-rock interaction; Pollution; Irrigation return flow; Suitability; Recent recharge; Paleoclimatic recharge; Hammamet-Nabeul; Northeastern Tunisia.

Abstract: The major ion hydrochemistry, sodium absorption ratio (SAR), sodium percentage, and isotopic signatures of Hammamet-Nabeul groundwaters were used to identify the processes that control the mineralization, irrigation suitability, and origin of different water bodies. This investigation high-lights that groundwater mineralization is mainly influenced by water-rock interaction and pollution by the return flow of irrigation water. The comparison of groundwater quality with irrigation suitability standards proves that most parts of groundwater are unacceptable for irrigation and this longterm practice may result in a significant increase of the salinity and alkalinity in the soils. Based on isotopic signatures, the shallow aquifer groundwater samples were classified into (i) waters with depleted $\delta^{18}O$ and $\delta\ ^{2}H$ contents, highlighting recharge by modern precipitation, and (ii) waters with enriched stable isotope contents, reflecting the significance of recharge by contaminated water derived from the return flow of evaporated irrigation waters. The deep-aquifer groundwater samples were also classified into (i) waters with relatively enriched isotope contents derived from modern recharge and mixed with shallow-aquifer groundwater and (ii) waters with depleted stable isotope contents reflecting a paleoclimatic origin. Tritium data permit to identify three origins of recharge, i.e., contemporaneous, post-nuclear, and pre-nuclear. Carbon-14 activities demonstrate the existence of old paleoclimatic recharge related to the Holocene and Late Pleistocene humid periods.

In: Arabian Journal of Geosciences; vol. 10, n° 20, 2017, 446-13 p.

62 : GIS-based evaluation of groundwater quality and estimation of soil salinization and land degradation risks in an arid Mediterranean site (SW Tunisia). BESSER H., MOKADEM N., REDHOUANIA B.

Keywords: CI; Heavy metals; Land degradation; Groundwater quality; Chotts Basin; SW Tunisia; Algeria; Arid Mediterranean site.

Abstract: Southwestern Tunisia is known for its high-quality data palm production. The agricultural activity supports the social and economic pressure. Considering prolonged drought conditions and surface water insufficiency, increasing supplies rely on deep aquifers in spite of the critical status of the water quality used. Intense agriculture development has placed oases durability and crop quality to high risks of soil fertility loss, land degradation, and water availability issues, due to severe climate conditions, overexploitation of groundwater resources, intense desertification, overuse of soil, and poor land management. The recent contamination of the largest aquifer in Southern Tunisia (Continental Intercalaire) by petroleum flows adds another dimension to the problem of water crisis and soil salinization in the region of interest. In this study, 41 water samples from CI wells were correspondingly collected for hydrochemical analyses. Major and minor elment concentrations were evaluated by different standard methods. The obtained dataset indicates that the western side possesses low salinity hazard, whereas Nefzaoua and El Fedjej areas reveal highly mineralized water unsuitable for irrigation purposes. A number of assessment ratios (KR/ TH, SAR, ESP, PS, etc.) and graphical methods (Riverside and

Wilcox) confirm this classification. The combination of geochemical indicators with geographic information system permits the assessment of water quality on the basis of two different indexes. The resulted maps show, in turn, scattered classification between the western field with acceptable water quality and El Fedjej-Nefzaoua areas where the CI water is unsuitable for agricultural activities. Besides water chemistry evaluation, the assessment of soil composition, particulaly toxic element concentrations, constitutes reliable criteria for monitoring the effectiveness of agricultural practices and the suitability of irrigation water. Hence, the concentrations of four heavy metals have been monitored along three soil profiles ranging from the surface to 80 cm of depth. The results are within permissible limits. The vertical distribution of Ni, Pb, Cu, and Zn is related mainly to physiochemical soil parameters, difference in moisture, and fine fraction distribution.

In : Arabian Journal of Geosciences; vol. 10, n° 16, 2017, 350-20 p.

63 : Assessment of groundwater quality and its suitability for domestic and agricultural uses in Low-Isser plain, Boumerdes, Algeria. BOUDERBALA A.

Keywords: Drinking water; Irrigation; Alluvial plain; Water quality index; Hydrogeochemistry; Low-Isser aquifer; Boumerdes; Algeria.

Abstract : The assessment of the suitability of groundwater for drinking and irrigation uses was carried out in the alluvial plain of Low-Isser in the North of Algeria. The plain covers an area of 533 km^2 and lies in a Mediterranean sub-humid climate. Groundwater is the main source for domestic uses and agricultural activities in this area. Groundwater samples were collected from 15 wells during dry and wet seasons in 2015, and they were analyzed for major cations and anions and compared with drinking and irrigation specification standars. The comparison of chemical concentration with WHO drinking water standards of 2006 shows that more than 30% of groundwater samples are unsuitable for drinking, and the majority of groundwater samples fell on the hard and very hard categories. Suitability of groundwater for drinking was also evaluated based on the water quality index (WQI). It shows more than 80% of samples have good or permissible water quality for dry and wet seasons. In terms of the irrigation usage, generally, groundwater in the study area is suitable for different use in both seasons according to SAR, %Na, RSBC, and PI. However, water rock exchange processes and groundwater flow have been responsible for the dominated water type Ca-Mg-C1 ;

In : Arabian Journal of Geosciences; vol. 10, n° 15, 2017, 333-13 p.

64 : Evaluation of sentinel-1 data for flood mapping in the upstream of Sidi Salem dam (Northern Tunisia). EZZINE A., DARRAGI F., RAJHI H., GHATASSI A.

Keywords: SAR; Flood mapping; Sentinel-1; Polarization; Medjerda Basin; Tunisia; Algeria.

Abstract : Flood mapping is a powerful asset that allows drawing better strategies to contain possible economic repercussions and to rescue the affected population. This work is directly unfolded after the rainfall events that occurred in the north of the country, in February 2015, during which certain cities located in the vicinity of the Tunisian basin of Medjerda were flooded by the overflow of the Medjerda river, causing important damage to the towns of Jendouba and Bou Salem. The present research illustrates the potentiality of Sentinel-1 sensor in detecting flood areas in the upstream of Medjerda river. The Medjerda is the most important river in Tunisia, with an annual water potential reaching 0.8 billion m^3. We compared the signature of flood water in vertical transmit and horizontal received (VH) and vertical transmit and vertical received (VV) polarizations of radar data. The study proves that the segregation of land/water areas with a threshold technique is better observed in VH polarization rather than VV polarization.

In : Arabian Journal of Geosciences; vol. 11, n° 8, 2018, 170-9 p.

65 : Multivariate statistical analysis of the groundwater flow in shallow aquifers : a case of the Basins of Northern Algeria. GUEZGOUZ N., BOUTOUTAOU DJ., ZEGGANE H., CHEFROUR A.

Keywords: Multivariate statistical; Principal component analysis; Groundwater flow; Basins of Northern Algeria.

Abstract: Water resources in Algeria are mainly controlled by climate change which creates enormous problems in its planning, management and distribution. While the surface water resources are perfectly managed and operated by means of dams and small dams built for several years, the groundwater resources remain long unknown and unusable because of the lack of relevant working tools (e.g., methods, formulas, maps, etc.) for planners and engineers working in the field of water resources exploration. To highlight the hydrodynamic processes of groundwater in shallow aquifers of the basins of northern Algeria, we conducted a study using 81 subwatersheds collected from different locations at the basins; taking into account the climatic and geomorphological factors, to understand water usage trends, analyse patterns, tap good

shallow aquifers and ensure long lasting supplies of water through arid periods, mapping and modelling of groundwater are fundamental to problem resolution. Multivariate statistical techniques as well as cluster and principal component analysis were applied to the data on groundwater flow, with the objective of defining the main controls on the groundwater flows at the basins. These statistical techniques showed the presence of three groundwater flow groups with increasing importance according to precipitation.The first group was mainly influenced by climatic factors, the second was more controlled by the communication between the surface and underground flows and the third group revealed the influence of geomorphological factors on groundwater flows.

In: Arabian Journal of Geosciences; vol. 10, n° 15, 2017, 336-8 p.

66: Spatial mapping of irrigation groundwater quality of the High Mekerra watershed (Northern Algeria). HALLOUCHE B., HADJI F., MAROK A., BENAABIDATE L.

Keywords: Groundwater quality; Irrigation; GIS; IWQI; High Mekerra watershed; Northern Algeria.

Abstract: The spatial assessment of water quality for irrigation is of great importance for agricultural issues. Assessing the suitability of groundwater for irrigation is carried out for the first time in the High Mekerra watershed. Groundwater samples were collected during the wet season (March 2013) and analyzed for determining the physicochemical properties. The indices used in the quality assessment were the sodium adsorption ratio (SAR), residual sodium carbonate (RSC), sodium percentage (%Na^+), permeability index (PI), magnesium hazard (MH), Kelly's ratio (KR), and irrigation water quality index (IWQI), incorporating the spatial variation using the GIS-based multi-criteria system. Result showed that most of groundwater samples have low sodium hazard and high to very high salinity hazard and could be used for irrigation on almost all types of soil with little risk of exchangeable sodium. The GIS-based multi-criteria system highlighted the spatial variation of groundwater quality for irrigation in the study area. This spatial distribution indicated that groundwater is generally of moderate quality and that the Ras el Ma aquifer quality is better than for Mouley Slissen aquifer.

In: Arabian Journal of Geosciences; vol. 10, n°11, 2017, 233-15 p.

67 : Spatial and temporal variability of rainfall: case of Bizerte-Ichkeul Basin (Northern Tunisia). JEMAI H., ELLOUZE M., ABIDA H, LAIGNEL B.

Keywords: Precipitation; Standardized precipitation ratio; Continuous wavelets; Bizerte-Ichkeul Basin; Tunisia.

Abstract : This study examines spatial and temporal variability of rainfall in Bizerte-Ichkeul watershed. The basin, located in the extreme north of Tunisia, covers an area of 3084 km^2. Thirteen rainfall stations, with continuous monthly precipitation records over the period (1970-2011), were considered in the analysis. Two methods were used. In the first, the dimensionless standardized precipitation ratio is applied to examine precipitation temporal variation. The second method is represented by continuous wavelet analysis for the precipitation spatial analysis and the identification of the origin of its variability. The study of temporal variability of annual rainfall showed severe persistent and recurrent drought episodes over the period (1977-2001). Wavelet analysis resulted in detecting the modes and origins of precipitation variability. Three energy bands were clearly identified: (1,2-4, and 4-8 years) for the entire watershed. The visualization of the power distribution showed that the observed modes of variability are different in their power distributions from one station to another. The approach adopted allowed the identification of two groups with the same precipitation frequency and temporal variation. These groups were defined according to the difference in occurrence of the frequency band for each station.

In : Arabian Journal of Geosciences; vol. 11, n° 8, 2018, 177-12 p.

68 : Combined hydrogeological and nitrate modelling to manage water resources of the Middle Soummam aquifer, Northeast of Algeria. KESSASRA F., MESBAH M., KHEMISSA Z., BOUAB N., KHALED-KHODJA S., LAMARI H.

Keywords: Hydrogeological model; Nitrates model; Water management; Alluvial aquifer; Middle Soummam; Algeria.

Abstract : Water management is one of the most challenges in Algeria, a semi-arid Mediterranean country confronted to a serious water stress. The country will have to endure, beyond 2025, a situation of chronic water penury, adding an excessive pollution of the majority of groundwater reservoirs. The management of water resources by combined approach using hydrogeological model and nitrates evolution model was experimented in the Middle Soummam valley. The alluvial aquifer, offering good hydrodynamic and geometrical characteristics, is over-exploited, providing in drinking water

Akbou and Tazmalt cities and irrigation perimeters. If exploitation continues at these steady paces, the depletion of the water resource and the hydrochemical imbalance will be inevitable. On the one hand, the results of hydrodynamic model, based on an increase of the water takings and simulated needs from 24.71 Mm^3/year in 2015 into 39.69 Mm^3/year in 2030, show a critical withdrawal. The aquifer budget expresses the inversion of flow between the wadi and the aquifer where the wadi feeds the groundwater reservoir. This hydrodynamic inversion was attributed to simulated pumping rates which increased and exceeded 100 000 m^3/day, but the aquifer was partially relieved by the weight of the exploitation through Tichy Haf dam. The water management strategy adopted in this study was based on management measures promoting zones, which have been delimited between Tazmalt and Akbou, and containing important water quantities available in the axis of the valley. However, according to the depleted in isotopes of ^{18}O and ^{2}H, which could be explained by the influence of a paleoclimatic effect and suggested that the aquifer recharge would have largely been made under a colder climate, pumped groundwater could be old, and the implementation of new pumping sites has been studied minutely. On the other hand, the hydrogeochemical modelling allowed following nitrates concentrations in order to project their evolution. Four wells on 25 react in face to the imposed conditions in each scenario simulated until 2030, showing inertia of pollution, and confirmed after three series of tests. This inertia would be related to the hydraulic gradients and hydraulic conductivities, aquifer thickness and recharge. The low hydraulic gradients lead to a rather slow flow velocity and thus to an inertia in the dispersion of nitrates, with a mass transport weakened by the hydrodynamic conditions. It is also related to the aquifer thickness; when the aquifer is powerful (65-85 m), the stock of water would be important and allows a dilution process. The reverse is true for the simulated boreholes where the concentrations remain invariant; the aquifer is less powerful (32-37 m). Finally, the recharge effect through the rain was evoked ; the aquifer is unconfined, and the rain water and pollution that reached the piezometric level can remain in position in slow hydrodynamic conditions. The methodology was demonstrated through a combination of monitoring and modelling for both water quantity and quality and the importance to use numerical models to support water resources management strategy in the Mediterranean aquifers.

In : Arabian Journal of Geosciences; vol. 10, n° 16, 2017, 368-20 p.

69 : Regionalisation of the « intensity-duration-frequency » curves in Northern Algeria. KHELFI A.E., TOUAIBIA B., GUASTALDI E.

Keywords: IDF; b Montana; Collocated co-kriging; Maximum annual rain; Climatic parameter; Northern Algeria.

Abstract : The flood events observed during last years in the urban areas are subject of main interest for quantification of the hydro-climatic risks and climatic change to the regional scales. The establishment of a statistical relationship between the intensities of intense rains and the recurrence of these events allows us to determine the dimensions of the works according to a previously defined level of risk. They constitute today a leading tool for various users. This work concerns the study of the maximum annual rains, recorded at 49 stations in the Northern Algeria. The objectives of this work are to determine the estimators who are the « intensity-duration-frequency » curves and to extract from these whole of information the b Montana climatic parameter to be regionalized for the calculating the river flow and for the dimensioning of the networks of cleansing in the event of insufficiency of data. Different durations going from 15 min to 24 h are studied. We utilised the collocated co-kriging as multivariate estimation method for interpolation in order to yield the space distribution maps of b Montana climatic parameter, with the benefit of using spatially correlated secondary variables, such as the digital elevation model and the distance from the coastline that are known at any localisation. All features let to choose the digital elevation model as covariate for interpolating b Montana values, yielding a better regionalisation of the studied climatic parameter. The geostatistical handling of b Montana values strictly related to auxiliary variables that constitute physical factors overcomes the data shortage in planning, managing and preventing the rain flood risk.

In : Arabian Journal of Geosciences; vol. 10, n° 20, 2017, 441-13 p.

70 : GIS-based GALDIT method for vulnerability assessment to seawater intrusion of the Quaternary coastal Collo aquifer (NE Algeria). BOULABEIZ M., KLEBINGAT S., BELGACEM H. BOUSNOUBRA H.

Keywords: Aquifer vulnerability; Seawater intrusion; GALDIT; GIS; Collo; Algeria.

Abstract: The overexploitation of groundwater in coastal aquifers is often accompanied by seawater intrusion, intensified by climate change and sea level rise. Heading long-term water quality safety and thus the determination of vulnerable zones to seawater intrusion becomes a significant hydrogeological task for many coastal areas. Due to this background, the present study focussed the established methodology of the GIS-based GALDIT model to assess the aquifer vulnerability to seawater intrusion for the Algerian example of the Quaternary coastal Collo aquifer. According to the result analysis overall, more than half of the total surface of the northern study area can be classified as highly vulnerable.

Besides the coastline, the areas nearby the local wadis of Guebli and Cherka occur to be the most vulnerable in the region. In view of further map removal performance as well as single parameter sensitivity analyses from a coupled perspective respectively the GALDIT parameters, distance from the shore (D) and aquifer hydraulic conductivity (A) have been found to be key significance regarding the model results (mean effective weightings 18-19%). Overall, the study results provide a good approximation basis for future management decisions of the Collo aquifer region, including various perspectives such as identification of suitable settings for prospective groundwater pumping wells.

In : Arabian Journal of Geosciences; vol. 11, n° 4, 2018, 71-14 p.

71 : The November 26 and 27, 1927 devastating flood event (NW Algeria): characterization and reconstruction using historical data. SARDOU M., MAOUCHE S., SABEUR B., MISSOUM H.

Keywords: Flood; Historical data; Dam failure; Northwestern Algeria.

Abstract: The historical records show that the Northwestern Algeria has experienced more than 130 floods, which were sometimes catastrophic. They caused more than 1000 deaths and significant damage. In this work, we try to reconstruct the most devastating and deadly historical flood that occurred on November 26 and 27, 1927. This event is interesting to discuss disaster scenario because of its extent and impacts and the availability of data. For this purpose, we used historical press reports, scientific papers, and archival reports. This work allowed the reconstruction of the hydroclimatic situation during the flood and the regional scale impacts. It presents also the catastrophic flooding of the Ain Sefra river at Mostaganem and that of El Hammam river, as well as the Fergoug dam breaking at Mohammadia. The main factor triggering these floods was the heavy rainfall. Other factors have increased the damage such as the occupation of high-risk areas and the human failure. This event caused 430 killed persons, more than 1200 disaster victims, and around one billion francs losses. These effects evidence the high vulnerability of the Northwestern Algeria to the occurrence of floods. For that, if a similar event occurs in the future, it can be extremely negative.

In : Arabian Journal of Geosciences; vol. 11, n° 10, 2018, 229-15 p.

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72 : Seismotectonic and seismological aspects of the Mostaganem (Western Algeria) May 22, 2014 (Mw 4.9) seismic event. ABBOUDA M., BOUHADAD Y., BENFEDDA A., SLIMANI A.

Keywords: Earthquake; Faulted folds; Accelerograph records; Waveforms inversion; Mostaganem; Western Algeria.

Abstract: On Thursday, 22 of May 2014, at 6h 22 min 0.3.3. s (GMT+1) a moderate-sized earthquake struck the Mostaganem, Western Algeria, region. The main shock, recorded by many international and national seismological stations, was proceded by a foreshock, 3 hours before, on May 22, 2014 (M1=4.1) at 3 h 57 min 41.4 s and followed by four well-felt aftershocks (M>3.0) that lasted about 1 year. The main shock did not cause loss of lives but serious panic among he population was reported. The main shock, however, caused cracks in walls and roofs, sometimes destroyed, the old non-engineered and precarious adobe dweller corresponding to Io=VI-VII (Msk scale). We used accelerograph records to (i) determine the epicenter location (longitude=0 .3537 E, latitude=35.8598 N, (ii) perform waveforms inversion to calculate the earthquake parameters. The obtained results are, respectively, the seismic moment (M_o)=2.71 E + 16, the Mw=4.9 and the focal depth=6 km. The obtained focal mechanism solution shows reverse faulting with small right lateral component with the following nodal plans : NP1, strike=193.5, dip=49.5, slip=57.6 and NP2, strike=57.8, dip=50, slip=122.1. On the other hand, the seismotectonic framework of the Dahra area exhibits a serie of NE-SW trending « en echelon » faulted folds that may be active as suggested by this study.

In : Arabian Journal of Geosciences; vol. 11, n° 3, 2018, 57-9 p.

73 : Chemical remagnetization acquisition processes: case study of the Saharan basins (Algeria). AMENNA M., DERDER M.EM., HENRY B., MAOUCHE S., BAYOU B., BESTANDJI R., BOUABDALLAH H., OUABADI A., AYACHE M., BEDDIAF M.

Keywords: Paleomagnetism; Ordovician- Silurian; Chemical remagnetizations; Cenozoic; Saharan basins; Algeria.

Abstract : In Ordovician and Silurian sedimentary formations of the Murzuq Basin (Saharan platform, Algeria), different remagnetization processes have been highlighted. These magnetic overprints totally replaced the primary magnetization. They are mainly due to chemical phenomena. Even in a site affected by contact metamorphism during Devonian, chemical changes, associated to the acquisition of the thermo-remanent overprint, were important, affecting the characteristics of

the magnetite grains. In the remaining sites, remagnetizations of Cenozoic age have also a chemical origin and are carried by magnetite as well as by hematite. Contrary to what is generally deemed, these remagnetizations processe appeared limited to very short duration of acquisition, and to very local geographical extension.

In : Arabian Journal of Geosciences; vol. 10, n° 17, 2017, 379-17 p.

74: Mediterranean sea and anthropogenic influences on ambient vibration amplitudes in the low-frequency and high-frequency domains in the Algiers region. BENSALEM R., CHATELAIN J.-L., MACHANE DJ., OUBAICHE E., BENCHELOUH A., BENKACI N., MOULOUEL H., CHABANE S., HELLEL M.

Keywords: Ambient vibration; Spectral amplitude; H/V spectral ratio; Climatic conditions; Algiers.

Abstract: Ambient vibrations have been continuously recorded at Dar El Beida, about 20 km from Algiers (Algeria). This data set allows determining that, in the low-frequency domain (<1 Hz), ambient vibration sources are mainly linked to Mediterranean sea effects, while in the high-frequency domain, they are closely related to anthropogenic activity. Climatic conditions have an influence on the ambient vibration spectral amplitudes in the low-frequency domain, which is not the case in the high-frequency domain. The limit between the low-frequency and high-frequency domain, based on natural versus anthropogenic activity, is not clear cut and lies between 1.25 and 1.50 Hz. Variations of H/V peak amplitudes in the low-frequency domain are clearly linked to the climatic conditions. In the high-frequency domain are clearly lonked to the climatic conditions. In the high-frequency domain, H/V peaks are not related to climatic conditions and cannot be clearly related to anthropogenic source changes.

In: Arabian Journal of Geosciences; vol. 10, n° 13, 2017, 282-12 p.

75: Combined application of vertical electrical sounding and 2D electrical resistivity imaging for geothermal groundwater characterization: Hammam Sayala hot spring case study (NW Tunisia). CHABAANE A., REDHAOUNIA B., GABTNI H.

Keywords: ERT; IP; VES; Geothermal; Hot spring; Hammam Sayala; NW Tunisia.

Abstract: The following work is an attempt to enhance and optimize the potential exploitation of the Hammam Sayala thermal spring (NW Tunisia). This hot spring is located at 10 km of South-western Béja city, with higher temperature values around 42 °C and a low discharge value of about 1 ls^{-1}. The geological and structural settings of the study area are complex and associated with faults and Triassic intruded salt and evaporate.

An integrated geophysical approach using electrical resistivity tomograpgy (ERT), induced polarization (IP) and vertical electrical sounding (VES) techniques can provide a high-resolution subsurface image of the principal geothermal plume and associated pathways. These data were used to determine and understand the mechanisms responsible of the rise of hot water flowing out onto the surface.

Our results add new information of the hydrothermal system's context in Hammam Sayala area, which can help to create a therapeutic center opening new perspectives in the Béja region and to encourage regional thermal tourism development.

In: Journal of African Earth Sciences; vol. 134, 2017, p. 292-298.

76 : Geophysics for the mineral exploration geoscientist. DENTITH M., MUDGE S.T.

Keywords: Geophysics; Earth scientists; Gravity; Magnetic methods; Radiometric method; Electrical methods ; Electromagnetic methods; Seismic method.

Abstract: High global demand for mineral commodities has led to increasing application of geophysical technologies to a wide variety of mineral deposits. Co-authored by a university professor and an industry geophysicist, this state-of-the-art overview of geophysical methods provides a careful balance between principles and practice. It takes readers from the basic physical phenomena, through the acquisition and processing of geophysical data, to the creation of subsurface models and their geological interpretation.

- Presents detailed descriptions of all the main geophysical methods, including gravity, magnetic, radiometric, electrical, electromagnetic and seismic methods.
- Explains the cutting-edge current practice in exploration and mining geophysics for the discovery of 'blind' mineral deposits.
- Describes techniques in a consistent way and without the use of complex mathematics, enabling easy comparison between the various methods.
- Gives a practical guide to data acquisition, processing and accurate interpretation of geophysical datasets.

- Includes presentation and analysis of new petrophysical data, giving geologists and geophysicists key information on the physical properties of rocks.
- Emphasises extraction of maximum geological information from geophysical data, providing explanations of data modelling, and common interpretation pitfalls.
- Provides examples from all the main types of mineral deposit around the world, giving students exposure to real geophysical data.
- Richly illustrated with over 300 full-colour figures, with access to electronic versions for instructors

Designed for advanced undergraduate and graduate courses in minerals geoscience and geology, this book is also a valuable reference for geologists and professionals in the mining industry wishing to make greater use of geophysical methods.

In: Ed. Cambridge; 2014, 438 p.

77: Probabilistic seismic hazard assessment in the northeastern part of Algeria. HAMLAOUI M., VANNESTE K., BADDARI K., LOUAIL L., VLEMINCKX B., DEMDOUM A.

Keywords: Area source; Seismic hazard; Probabilistic approach; Peak ground acceleration; Algeria.

Abstract: This work involves updating the evaluation of seismic hazard in Northeast Algeria by a probabilistic approach.This reassessment attempts to resolve inconsistencies between seismic zoning in regional building codes and is further motivated by the need to refine the input data that are used to evaluate seismic hazard scenarios. We adopted a seismotectonic model that accounts for differences in interpretations of regional seismicity. We then performed a probabilistic assessment of regional seismic hazard in Northeast Algeria. Based on a homogeneous earthquake catalog and geological and seismotectonic data gathered in the first part of the study, a seismotectonic zoning map was created and seven risk areas were identified. For each area, peak ground acceleration hazard maps were produced. Details of the calculations are provided, including hazard curves at periods of 0.1, 0.2, 0.33, 0.5, 1.0, and 2.0 s and uniform hazard spectra at urban locations in the area, including Sétif, Constantine, Kherrata, Bejaia, and Jijel.

In: Arabian Journal of Geosciences; vol. 10, n° 11, 2017, 238-14 p.

78: Simultaneous inversion application for characterizing Hamra quartzite tight sand reservoir: a case study from Hassi Messaoud (Algeria). IDDIR SADI M., YAHIAOUI A., DJEDDI M.

Keywords: Simultaneous inversion; LMR method; Reservoir characterization; Hassi Messaoud; Algeria.

Abstract: Channel sand acts as a stratigraphic trap for hydrocarbon accumulation in many parts of the world. Delineation of this type of reservoir is crucial as channel sand may be scarce, and inaccurate location of the drilling wells could lose a huge currency. The Hassi Messaoud (HMD) field was subjected to multiphase tectonic events, where deep-seated structures where rejuvenated leading to intensive fault complexity. The main effective tectonic events upon the studied area are the Hercynian compression and deep erosion till the Ordovician Hamra Quartzite (HQZ) oil reservoir, followed by active Triassic rifting and filling the deeply eroded areas or the graben areas by eruptive volcanic rocks at Triassic time. Hercynian erosion and volcanic rocks distribution introduce a big uncertainty to the reservoir structural model. Amplitude versus offset (AVO) method is used as a helpful tool to differentiate channel sand from surrounding formations. Several attributes (P-impedance, S-impedance, longitudinal velocity V*p*, shear velocity Vs and density ρ) are estimated from pre-stack seismic inversion. They have different sensitivity to the reservoir properties. Derived attributes such as Lamé parameters, incompressibility x density (λρ) and rigidity x density (μρ) can provide key lithology and fluid indicators (Goodway et *al*. 1997, Goodway CSEG Rec 26(6):39-60 2001). Petrophysically relating AVO attributes both λρ and μρ and to each other in Lambda-Mu-Rho (LMR) cross-plot space can be a good tool for AVO interpretation (Rutherford and Williams Geophysics 54:680-688 1989 and Castagna and Swan lead Edge 16(4):337-342 1997). After proper data conditioning, simultaneous inversion of pre-stack angle gathers is performed to get acoustic wave impedance (P-impedance), elastic wave impedances (S-impedance) and density ρ, then to calculate ρ and ρ volumes. In the studied area, ρ and ρ are used as a very important key to separate reservoir sands. The ρ and ρ curves are generated at each well location. Cross plots showed a fair separation of sand in the formation, i.e. higher μρ and lower ρ can detect sand. The output ρ and ρ volumes after simultaneous inversion follow the distribution of the sand which is consistent with the wells penetrating the target reservoir. This finding on the extension of the sand reservoir in terms of ρ and ρ. 3D cross-plot zonations are used for lithology discrimination. In this study, well logs were used to constrain lithology and to control

the zonation filters by reducing the limits ambiguity. Other types of advanced attributes are calculated and tested. The obtained (ρ - ρ) volume acts as a good indicator for the sand distribution. It was finally used as sand presence index in the area. Also μρ has shown a good linear relationship with porosity. To note that the porosity volume is created based on the linear relationship with μρ. A product of derived prosity and the sand presence index (μρ - ρ) provides a good tool for reservoir characterization and lead to reservoir management, future planning of the field, and setting location for new wells.

In: Arabian Journal of Geosciences; vol. 10, n° 13, 2017, 279-19 p.

79 : Subsurface geophysics applied to archaeological investigation of Thabudeos Roman fortress (Biskra, Algeria). KHOUAS A., HAMOUDI M., KHALDAOUI F., MIHOUBI H., HADJI Y.R.

Keywords: Geophysics; Archaeology; Electromagnetics; EM31; Electrical resistivity tomography; Tahouda; Thabudeos; Biskra; Algeria.

Abstract: Tahouda, former Roman Thabudeos, is situated 400 km south of Algiers (Algeria). It is one of the fortresses belonging to Roman south defence line in North Africa. This region is archaeologically very poorly known except for surface remains. The geophysical survey formed part of a wider research project designed to record and assess the landscape context of the longest Roman defense line in North Africa. We present the geophysical mapping and imaging using electric resistivity tomography and electromagnetics to help in investigating the subsurface properties of the region. Data were obtained using: (1) saris resistance meter with up to 25 electrodes spaced at 2 m intervals and lines up to 50 m long. A total of 11 lines was obtained. (2) geonics EM31, in two dipole configuration modes with 16 lines up to 100 m sampled every meter. These methods prove to be very powerful tools to give insight and locate the anthropologic remains from the surface to a depth of 6 m and outline their geometry. The results obtained by the two methods are consistent above the main remains like walls and rooms.

In: Arabian Journal of Geosciences; vol. 10, n° 23, 2017, 522-15 p.

80: A support for the existence of paleolakes and paleorivers buried under Saharan sand by means of "gravitational signal" from EIGEN 6C4. KLOKOCNIK J., KOSTELECKY J., CILEK V.

Keywords: Gravitational field model EIGEN 6C4; Functions of disturbing geopotential; Satellite digital topography models; Paleolakes/paleorivers; GOCE satellite; Sahara.

Abstract: The goal of this study is to demonstrate that and how the recent gravitational and topographic data support the findings made by geologists and others as for the existence of the paleolakes and paleoriver systems, now buried under the sands of Sahara. It is always important and useful to have such an independent analysis supporting certain results, and this paper is such a case. We make use of the gravity disturbances (or anomalies), the Marussi tensor of the second derivatives of the disturbing geopotential, the gravitational invariants and their certain ratio, the strike angle and the virtual deformations. The geopotential, is represented by the global combined (from satellite and terrestrial data) high-resolution gravity field model EIGEN 6C4 (till degree and order 2160 in spherical harmonic expansion). The topography is derived from the ASTER GDEM and ETOPO 1 models (both are used). With all these data, we confirm the existence of huge paleolakes or paleoriver systems under the Saharan sands known or anticipated in an independent way by geologists for the lakes MegaChad, Fazzan and Chotts; for Tamanrasset river valley; and Kufrah Basin, presumptive previous flow of the Nile river. Moreover, we suggest a part of the Grand Egyptian sand sea as another "candidate" for a paleolake and hence for a follow-up survey.

In: Arabian Journal of Geosciences; vol. 10, n° 9, 2017, 199-28 p.

81 : Aeromagnetic surveys. Principles, practice & interpretation. REEVES C.

Keywords : Aeromagnetic survey; Magnetic fields; Magnetometers; Airborne methods.

Abstract : The present volume is a treatise devoted to aeromagnetic interpretation that dealt with the integration of gravity and gamma-ray spectrometry data with geology and that is illustrated with examples from all over the world and from a representative variety of geological terranes. Ideally this would lead into another treatise on the contribution all this can make to understanding the way global geology has evolved over geological time.

In: Ed. Geosoft; 2005, Pagination multiple.

82 : Assessment of the Aeolian sand dynamics in the region of Ain Sefra (Western Algeria), using wind data and satellite imagery. BOUARFA S., BELLAL S.A.

Keywords: Arid region; Drift potential; Dune form; Effective winds; Sand; Sand encroachment; Ain Sefra; Western Algeria.

Abstract: The region of Ain Sefra is an arid region suffering from sand encroachment. In this study, we are calculating the shifted sand quantity and efficient wind directions during a period of 30 years (1985 to 2015) in order to classify the danger. The study shows that efficient winds in the region are characterized by their potential drift estimated at 220 till 329. This classifies the region as medium. Besides, the resultant drift potential is 76 to 99 with a migration coefficient of 0.3 which gives a medium classification to the zone and proves the Aeolian erosion complex system and its interrelation with other factors. Efficient winds generally blow from South-West to North-East with an angle of 234°. Furthermore, there are other directions causing sand drifting. Sand movement quantity is estimated between 23,03 and 15,224 $m^3/m/year$ according to effective wind threshold speed, which is 5 to 6 m/s. Autumn is the period when sand mobility is higher, but it decreases in winter. On the other hand, sand potential movement was well shown through satellite imagery between 1985 and 2015. Indeed, it closely corresponded to the previous study. It showed sand movement direction from South-West to North-East, and sand surface increase reached 16.44% of the global zone surface. Whereas, it decreased – 2.5% between 1985 and 2015. There is an important concentration of sand accumulation under the western mountain foothills along which sand moves. This shows that the ground particularities play a crucial role in this phenomenon.

In: Arabian Journal of Geosciences; vol. 11, n° 3, 2018, 56-16 p.

83: Vulnerability assessment of coastal areas to sea level rise from the physical and socioeconomic parameters: case of the Gulf coast of Bejaia, Algeria. DJOUDER F., BOUTIBA M.

Keywords: Geomorphology; Risk ; Geographical information systems; CVI; Gulf Coast of Bejaia; Mediterranean sea level rise.

Abstract: The study area (the Gulf of Bejaia) is a coastal zone of about 70 km long in the eastern-central part of the Algerian coast. The coastline characterized by sandy beaches, hotels and tourist facilities, airport, port, villages and towns has known during these last decades several threats like storms, floods and erosion. The present work concerns the mapping of the physical and socioeconomic vulnerability of the Gulf Coast of Bejaia to sea level rise, using coastal vulnerability index (CVI) and geospatial tools. The physical CVI (CVI_{Phys}) is calculated from seven physical variables: geomorphology, coastal slope, coastal regional elevation, sea level rise rate, shoreline erosion/accretion rates, tidal range and significant wave height. On the other hand, the parameters population, cultural heritage, roads, railways, land use and conservation designation constitute, for their part, the socioeconomic CVI (CVI_{eco}). The values obtained from the calculation of CVI_{Phys} vary between 3.53 and 81.83. These results revealed that 22.42 km of the studied coastline has a low physical vulnerability, 21.68 km a high vulnerability and 15.83 km a very high vulnerability, indicating that the most part of the coastline (53.59%) is vulnerable to sea level rise. According to the obtained values of CVI_{eco}, the most vulnerable areas of high and very high risk represent 31.81 km of the total coastline. They were found along the western (Bejaia and Tichy) and eastern (Aokas, Souk El Tenine and Melbou) coast, while the least vulnerable stretches, covering 38.19 km of the total length of the coast, occupy the rest of the area. This study highlighted areas that will be most affected by future sea level rise (SLR) and storm events. It revealed that several development projects of Bejaia Gulf Coast, including tourist expansion areas, are planned in sites identified as very vulnerable. The results obtained from this assessment could guide local planners and decision-makers in developing coastal management plans in the most vulnerable areas.

In: Arabian Journal of Geosciences; vol. 10, n° 14, 2017, 299-20 p.

84 : Modelling wind-erosion risk in the Laghouat region (Algeria) using geomatics approach. SAADOUD DJ., GUETTOUCHE M.S., HASSANI M., PEINADO F.J.M.

Keywords: Soil; Wind erosion; GIS; Remote sensing; Risk; Laghouat; Algeria.

Abstract: Wind-erosion risk is a challenge that threatens land development in dry-land regions. Soil analysis, remote sensing, climatic, vegetal cover and topographic data were used in a geographic information system (GIS), using multi-criteria analysis (MCA) to map wind-erosion risk (R_{we}) in Laghouat, Algeria. The approach was based on modelling the risk and incorporating topographic and climatic effects. The maps were coded according to their sensitivity to wind erosion and to their socio-economic potential, from low to vey high. By overlapping the effects of these layers, qualitative maps were drawn to reflect the potential sensitivity to wind erosion per unit area. The results indicated that severe wind

erosion affects mainly all the southern parts and some parts in the north of Laghouat, where wind-erosion hazard (H_{we}) is very high in 43% of the total area, and which was affected mainly by natural parameters such as soil, topography and wind. The result also identified features vulnerable to R_{we}. The product of the hazard and the stake maps indicated the potential risk areas that need preventive measures; this was more than half of the study area, making it essential to undertake environmental management and land-use planning.

In: Arabian Journal of Geosciences; vol. 10, n° 16, 2017, 363-19 p.

GEOLOGIE D'INGENIEUR

85: Landslide susceptibility mapping using analytic hierarchy process and information value methods along a highway road section in Constantine, Algeria. ACHOUR Y., BOUMEZBEUR A., HADJI R., CHOUABBI A., CAVALEIRO V., BENDAOUD E.A.

Keywords: Information value (IV); Landslide susceptibility index (LSI); Analytic hierarchy process (AHP); Remote sensing; Algeria.

Abstract: This research work deals with the landslide susceptibility assessment using analytic hierarchy process (AHP) and information value (IV) methods along a highway road section in Constantine region, NE Algeria. The landslide inventory map which has a total of 29 single landslide locations was created based on historical information, aerial photo interpretation, remote sensing images, and extensive field surveys. The different landslide influencing geoenvironmental factors considered for this study are lithology, slope gradient, slope aspect, distance from faults, land use, distance from streams, and geotechnical parameters. A thematic layer map is generated for every geoenvironmental factor using geographic information system (GIS); the lithological units and the distance from faults maps were extracted from the geological database of the region. The slope gradient, slope aspect, and distance from streams were calculated from the digital elevation model (DEM). Contemporary land use map was derived from satellite images and field study. Concerning the geotechnical parameters maps, they were determined making use of the geotechnical data from laboratory tests. The analysis of the relationships between the landslide-related factors and the landslide events was then carried out in GIS environment. The AUC plot showed that the susceptibility maps had a success rate of 77 and 66% for IV and AHP models, respectively. For that purpose, the IV model is better in predicting the occurrence of landslides than AHP one. Therefore, the information value method could be used as a landslide than AHP one. Therefore, the information value method could be used as a landslide susceptibility mapping zonation method along other sections of the A1 highway.

In: Arabian Journal of Geosciences; vol. 10, n° 8, 2017, 194-16 p.

86 : The El Achour (Algiers, Algeria) landslide delimitation using the H/V ambient vibration method. CHEIKH LOUNIS G., MIMOUNI O., MACHANE DJ., BACHA A.

Keywords: Landslide; H/Vmethod; Seismic ambient vibration; Rupture surfaces; Geotechnical; Algiers; Algeria.

Abstract: We present in this work investigations using seismic ambient vibration to delimitate the El Achour landslide (Algiers), upon which independent geotechnical studies were carried out. Acquisition campaign of ambient vibration on the El Achour site on June 2009 and June 2015, over a surface of about 2 ha, consisted of 64 records of ambient noise with a 10 to 20 m grid size. This approach consists of simple, light, and fast H/V acquisitions, in order to determine the extension of the unstable zone, the depth of the sliding surface, and to test the effectiveness of this method. Two peaks were interpreted as one being for the sliding surface and other for the lithological interface. As results, in the stable area, they are satisfactory. Indeed, the points in this area are not intermediate peaks which could be related to potential sliding surfaces, which led us to think that we could delineate, using this method, the unstable area from the stable area. The HVSR method allows to determine the thickness of the geological formations and to highlight the lateral and vertical facies changes in broad area.

In: Arabian Journal of Geosciences; vol. 10, n° 18, 2017, 398-10 p.

87: Effect of sodium sulphate on the shear strength of clayey soils stabilised with additives. GADOURI H., HARICHANE KH., GHRICI M.

Keywords: Clayey soil; Lime (L); Natural pozzolana (NP); Stabilisation; Sodium sulphate (Na_2SO_4); Shear strength; Algeria.

Abstract: The effect of sulphates on the soil stabilisation using mineral additives such as lime, cement and fly ash has been reported by several researchers. The effect of sodium sulphate (Na_2SO_4) (0-6% by dry weight of soil) on the behavior of the grey clayey soil (GS) and red clayey soil (RS) stabilised with lime (L) (0-8%), natural pozzolana (NP) (0-20%) and with a combination of lime-natural pozzolana (L-NP) was investigated. The soil specimens were subjected to testing of direct shear strength after 7,30, 60 and 120 days of curing period. In the absence of Na_2SO_4, the results show that both clayey soils can be successfully stabilised with L or with a combination of L-NP, which substantially increases their shear strength and produces high values of shear parameters. However, a short curing period and for any content of Na_2SO_4, a further increase in shear strength and shear parameters is observed. Moreover, after 30 days of curing, the RS specimens stabilized with L or with NP alone are altered when the Na_2SO_4 is greater than 2%, whereas the GS specimens are not altered. However, the alteration of RS specimens is little when the L and NP are combined on curing with a high content of Na_2SO_4. Generally, the effect of Na_2SO_4 on both stabilised clayey soils depends on the curing time, percentage of additives used and their type, mineralogical composition of stabilised soils and Na_2SO_4 content.

In: Arabian Journal of Geosciences; vol. 10, n° 10, 2017, 218-17 p.

88 : Estimation of uniaxial compressive strength of North Algeria sedimentary rocks using density, porosity, and Schmidt hardness. HEBIB R., BELHAI DJ., ALLOUL B.

Keywords: Petrography; Sandstones; Limestones; Correlations; Prediction; Coefficient of determination; North Algeria.

Abstract: This study aims to establish new correlations to assess uniaxial compressive strength (UCS) of Northern Algeria sedimentary rocks. This estimation is based on the measurements of density, porosity, and Schmidt hammer hardness. To achieve this goal, a geological and geotechnical characterization campaign was conducted on 19 types of sandstone and carbonate rocks which have been collected from different geological areas of the Maghrebides chain. Petrographic analyses were conducted to identify the geological characteristics of each kind of rock. Subsequently, phsico-mechanical tests (i.e., density, porosity, hardness, and uniaxial compressive strength) were carried out for all the sampled rocks. The results were then used to develop correlations between UCS values and the other parameter values determined. Finally, the UCS predictive aquations which have the best predictive powers (coefficient of determination R2 of 0.75 to 0.94) were discussed taking into account the geological specificities of the rocks, and then compared to similar studies developed by other authors in different areas of the world.

In: Arabian Journal of Geosciences; vol. 10, n° 17, 2017, 383-13 p.

89 : Numerical modeling to predict the spread of landslide of schist's area under climatic event of Ain EL Hammam (Algeria). ZERARKA H., AKCHICHE M., PRUNIER F.

Keywords: Landslide; Second-order work; Finite element; Electrical resistivity tomography; Equivalent plastic deviatory strain; Schist; Ain El Hammam; Algeria.

Abstract: The several reactivations of the landslide of Ain El Hammam (AEH) after each important weather event compel us to look closely at its triggering factors and predict its mechanisms and its evolution at the longer term. In this sense, the prediction of the slope behavior becomes necessary. This paper presents a numerical model of the AEH landslide using Plaxis®software. This model considers hydraulic effects such as precipitation and pore pressure even in the unsaturated parts. Soil and rock behaviors are described with proper elasto-plastic models named hardening soils and jointed rocks. The first model takes into account hardening on isotropic and deviatoric mechanism as well as non-associated flow rule. The second model considers a non-isotropic elasticity with perfect plasticity along with given sliding directions. The hydraulic and mechanical models are coupled with an effective stress concept. To detect unstable areas in the landslide, we developed a Matlab® program to take into account the Hill's bifurcation criterion, which is based on sign of the second-order work. It has been proved that this criterion allows detecting all failure modes that can appear in rate-allows detecting all failure modes that can appear in rate independent materials and especially the ones that develop before the plasticity limit criterion. From such computations, we can predict the shape and position of slip surface responsible of the actual ground movement of the slope. The validate the numerical results, analysis of field measurement is included. We use high resolution of electrical tomography to delineate the geometry and position of failure surface and approve our results.

In: Arabian Journal of Geosciences; vol. 10, n° 16, 2017, 370-13 p.

90 : Geochemistry of major and trace elements in sediments of Ghazaouet Bay (Western Algeria) : an assessment of metal pollution. BELHADJ H., AUBERT D., DALI YOUCEF N.

Keywords : Trace elements; Sediments; Pollution; Ghazaouet Bay; Algeria.

Abstract : Trace metals contaminations which impact littoral ecosystems result mainly from human activities (industrial, agricultural, or urban). Thus, the particles exported and accumulated in the coastal sediments are accurate anthropic pressure gauges on this kind of environment. Spatial variations of major and trace elements concentrations in the sediments of Ghazaouet Bay (Western coast of Algeria) have been monitored between july 2010 and June 2011. Contrasted gradients of trace metals concentrations are highlighted between the preserved zones and the strongly impacted areas. The geo-accumulation index (1_{geo}) and the enrichment factors (EF) show that the sediments in this coastal zone are highly polluted, especially by Zn, Cd, Cu, and Pb.

In : C. R. Acad. Geoscience; vol. 349, n° 8, 2017, p. 412-421.

91: Distribution and enrichment of heavy metals in Sabratha coastal sediments, Mediterranean sea, Libya. NOUR H.E., EL-SOROGY A.S.

Keywords: Enrichment; Heavy metals; Coastal sediments; Sabratha; Libya; Mediterranean sea.

Abstract: In order to assess heavy metal pollutants in Sabratha coastal sediments, Mediterranean sea, Libya, 30 sediment samples were collected for Fe, Cu, Pb, Mn, Cd, Co, Ni and Zn analysis using atomic absorption spectrometry. The analysis indicated that, the Sabratha's coastal sediments were enriched with Cd, Pb, Cu, Ni, Co and Zn (EF=81.48, 17.26, 12.80, 11.42, 9.85 and 8.56 respectively). The highest levels of Mn, Cu, Ni, Pb and Co were recorded nearby the Mellitah complex oil and gas station in the Western Libyan region, while the highest levels of Zn and Cd were recorded at the central part of the study are nearby fishing port and Sabratha hospital. Average values of Cd, Pb, and Co were mostly higher than the ones recorded from the Arabian and Oman gulfs, the Red Sea, the Gulf of Aqaba, the Caspian sea, coast of Tanzania and the background shale and the earth's crust. The high levels of most of the studied heavey metals suggested significant anthropogenic sources along Sabratha coast. The results of the present study provide a useful backround for further marine studies on the Mediterranean area.

In: Journal of African Earth Sciences; vol. 134, 2017, p. 222-229.

92: Effects of anthropogenic activities on the quality of surface water of Seybouse river (Northeast of the Algeria). REGGAM A., BOUCHELAGHEM E., SAAD H., HOUHAMDI M.

Keywords: Anthropological pollution; Quality of the water; The physical chemistry; The activity; Oued Seybouse; Algeria.

Abstract: This work aims to study the physico-chemical typology of Oued Seybouse river water that receives the sewage discharged by the localities and the industries located along this stream and the determination of the sources of pollution. These wastewaters contribute to the degradation of Oued Seybouse river water quality. Five water points were sampled on the bed of Oued Seybouse since the source Medjez Amar on the outskirts of the town of Sidi Salem (Annaba), with a monthly frequency during of 2 years (on 2012 and 2013). We analyzed eighteen (18) physico-chemical parameters (temperature, pH, conductivity, chlorides, sulfates, phosphates, nitrogenous components, oxygenates dissolved, oxidizible material, dry residue, total hardness, suspension materials…).

The main physico-chemical parameters of the quality of the water were thus measured then an analysis in main components was realized from the average values of every parameter; we were able to reveal so the existence of a spatial variation relatively marked with these descriptors, revealing four components very uneven and well differentiated. The interpretation of the results by means of these tools allowed to understand (include) that the parameters responsible for the quality of waters are connected for the component 1 (anthropological contributions: organic and mineral) and the components 2 and 3 respectively bound in the effects of seasonality's and the anthropological activities. The component 4 could be connected with the agricultural activities.

In: Arabian Journal of Geosciences; vol. 10, n° 10, 2017, 219 - 9 p.

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